

MONTHLY BULLETIN

OF THE

INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

(ENGLISH EDITION)

PUBLISHING and EDITORIAL OFFICES : 231, RUE ROYALE, BRUSSELS.

Yearly prepaid subscription { Belgium 70 Belgas { including postage
 { Other countries . . . 75 Belgas }

Price of this single copy : 8 Belgas (not including postage).

(1 Belga = 5 Belgian francs.)

Subscriptions and orders for single copies (January 1931 and later editions) to be addressed to the General Secretary, International Railway Congress Association, 231, rue Royale, Brussels (Belgium).

Orders for copies previous to January 1931 should be addressed to Messrs. Weissenbruch & Co. Ltd., Printers, 49, rue du Poinçon, Brussels.

Advertisements : All communications should be addressed to the Association, 231, rue Royale, Brussels.

CONTENTS OF THE NUMBER FOR JUNE 1937.

CONTENTS.	Page.
Special Accounts summing up the Reports on the questions for discussion at the thirteenth session of the International Railway Congress Association (Paris, 1937).	
Section I. — WAY AND WORKS :	
QUESTION I. — The construction of modern track to carry heavy loads at high speeds, and methods of modernising old track for such loads and speeds. Facing points which can be taken at high speeds, by H. FLAMENT	1487
QUESTION II. — Use of welding : (1) to obtain extra-long rails; (2) in manufacturing and repairing points and crossings, by Dr.-Ing. MÜLLER	1494
QUESTION III. — Methodical and periodical maintenance of : (1) metal bridges; (2) signals; (3) metal supports carrying the contact wire on electric railways, by Th. W. MUNDT	1505
Section II. — LOCOMOTIVES AND ROLLING STOCK :	
QUESTION IV. — Evolution of the rail motor car as regards its construction, and special investigation into the transmission and brake questions. Comparative methods of testing railcars. Detailed investigation into the cost price of railcars and the methods of reducing them, by L. DUMAS	1513
QUESTION V. — Recent improvements in steam locomotives of the usual type and tests of new designs. Testing locomotives at locomotive experimental stations, and in service with dynamometer cars and brake locomotives, by Sir. H. Nigel GRESLEY	1521
QUESTION VI. — Methods and devices used, in connection with electric traction, to save current between the supply side of the power station and the driving wheels (feeders, substations, tractors), and in particular the use of mercury rectifiers, by C. E. FAIRBURN	1528

CONTENTS <i>(continued)</i>	Page.
Section III. — WORKING :	
QUESTION VII. — Economical operation of the main line systems' secondary lines. Various methods adopted to adjust the operating facilities, safety measures, and station organisation to the volume of traffic, by G. C. PALMIERI	1538
QUESTION VIII. — Application of rational organisation (planning) to the transport of goods, by Dr.-Ing. A. BAUMANN	1548
QUESTION IX. — Results obtained from the automatic and distant operation of signals and points and from locomotive cab signals, by J. TUJA and A. LEMONNIER.	1562
Section IV. — GENERAL :	
QUESTION X. — Effects of the world crisis and road competition on the railway position. Corresponding changes in railway commercial policy, by Dr. COTTIER	1571
QUESTION XI. — Selection, orientation, and instruction of railway staff, by J. WOJCIECHOWSKI	1588
Section V. — LIGHT RAILWAYS AND COLONIAL RAILWAYS :	
QUESTION XII. — Co-ordination of operation as between main-line railways and light railways, by L. BELMONTE	1595
QUESTION XIII. — Specifications for the fixed plant of railways with light traffic, intended to prevent the use of unnecessarily expensive track equipment, and generally to give economical working, by A. SVOBODA	1604

LIBRARY

OF THE

Permanent Commission of the International Railway Congress Association.

READING ROOM : 231, rue Royale, Brussels.

Works in connection with railway matters, which are presented to the Permanent Commission, are mentioned in the « Bulletin ». They are filed and placed in the library. If the Executive Committee deems it advisable they are made the subject of a special notice. Books and publications placed in the reading room may be consulted by any person in possession of an introduction delivered by a member of the Association. Books, etc., may not be taken away except by special permission of the Executive Committee.

The Permanent Commission of the Association is not responsible for the opinions expressed in the articles published in the Bulletin.

All original articles and papers published in the BULLETIN are copyright, except with the consent of the Authors and the Committee.

Editions in French and in German are also published.

BULLETIN
OF THE
INTERNATIONAL RAILWAY CONGRESS
ASSOCIATION
(ENGLISH EDITION)

SPECIAL ACCOUNTS

summing up the reports on the questions for discussion at the
thirteenth Session of the International Railway Congress Association
(Paris, 1937).

SECTION I. — Way and works.

[623. 14]

QUESTION I.

The construction of modern track to carry heavy loads at high speeds, and methods of modernising old track for such loads and speeds. Facing points which can be taken at high speeds,

by H. FLAMENT,
Special Reporter.

Contents.

Preamble.

CHAPTER I. — Characteristics of present-day vehicles.

1. Weights of vehicles, and axle loads.
2. The actual forces set up in the track by vehicles in motion.
3. Vehicles running over curves at high speeds.

CHAPTER II. — Construction and modernization of the track to carry heavy loads moving at high speeds.

CHAPTER III. — Points and crossings run over at high speeds by heavy loads.

SUMMARY.

Preamble.

Three reports dealt with this Question:
Report (Germany, Austria, Belgium and Colony, Denmark, Finland, Hungary, Luxembourg, Norway, Netherlands and Colonies, Poland, Sweden and Switzerland), by Mr. C. LEMAIRE (See *Bulletin*, February 1937, p. 357/103);

Report (America, Great Britain, Dominions and Colonies, China and Japan), by Messrs. T. YAMADA and Y. HASHIGUCHI (See *Bulletin*, March 1937, p. 503/189);

Report (Bulgaria, Egypt, Spain, France and Colonies, Greece, Italy, Portugal and Colonies, Rumania, Czechoslovakia, Turkey and Yugoslavia), by Mr. H. FLAMENT (See *Bulletin*, December 1936, p. 1447/1).

This report is intended to sum up the above-mentioned reports and to state the *summaries* which can be drawn therefrom.

The work has been greatly facilitated by the careful way in which our Colleagues followed the plan of the questionnaire sent to the various Administrations after an exchange of views with Mr. LEMAIRE, Chief of the Permanent Way Department of the Belgian National Railways Company.

Although the report of Messrs. T. YAMADA and Y. HASHIGUCHI does not follow the questionnaire as exactly as the other two, most likely owing to the variety of data which has been collected and presented in great detail, it appeared to us desirable to follow the agreed plan when summing up the various matters dealt with, when giving the summaries which can be prepared therefrom.

* * *

CHAPTER I.

Characteristics of present-day vehicles.

1. *Weight of vehicles and axle loads.*

On the various Railways in countries other than North America, the maximum weight of the vehicles and maximum axle loads generally do not exceed 150 and 20 tons respectively.

This latter figure represents the maximum tonnage which in practice is permissible on most of the Railways when building new stock.

Two Administrations however, the Belgian National Railways Company and the French Nord Railway, allow modern locomotives with axle loads of 24 t. (23.6 Engl. tons) in the case of the former, and 22 t. (21.65 Engl. tons) in the case of the latter, to run over their main lines.

These figures are considerably exceeded by the various North American Rail-

ways. The total vehicle weight and axle loads of the heaviest locomotives on some United States and Canadian Railways are about 500 and 35 tons respectively.

Although no statements or detailed analyses of the reasons why the vehicle weights and axle loads are so different on the various Railways can be found in the reports, there is nonetheless a very great difference between those allowed in North America and those fixed by nearly all other Railways.

This fact, in our opinion, should be underlined so as to draw the attention of the Railways to it when they are considering the possibility of increasing the capacity or modifying the conditions under which their traffic is worked, by increasing the power or speed of their locomotives and the weight of their rolling stock. It seems to us desirable that the reason for such differences, which are almost in the proportion of one to two, as can be seen by the figures quoted above, should be analysed very closely, especially as regards the design, construction, general maintenance and behaviour of the track called upon to carry these various vehicles.

2. *Actual forces set up in the track by vehicles in motion.*

Two of the reports contain a study of the characteristics of vehicles based on comparisons which were used by the International Railway Union when classifying railways into five groups.

The results of each of these studies, summed up in the tables, show that as a rule they differ but slightly from the basic factors corresponding to the classification of the standard train formulæ used for the calculations of bridges, and deciding the tests they are to undergo.

The report of Messrs YAMADA and HASHIGUCHI includes, in connection with the maximum practical speeds over a line, a method of calculating the speed permissible over a curve of given radius

in terms of its superelevation and the characteristics of the vehicle, especially the height of its centre of gravity above rail level.

The three reports deal with the effect on the track of increasing the speeds much above those in use for some considerable time on the main lines. These consequences are often more serious than those resulting from a gradual increase in the weight and static loads of the vehicles. Indeed, the effect of the dynamic forces on the track and its substructure increases in a particularly appreciable manner.

The report of Messrs. YAMADA and HASHIGUCHI gives the formulæ adopted by the Japanese Government Railways, based on the results of experiments they have carried out, and those of the Special Commission appointed to investigate track stresses in the United States of America. They show that the combined effort of the speed and the unbalanced weights can increase the average stress recorded in the track components to a considerable extent, varying from 50 to 100 % according to the speed, and the type of locomotive.

Some of the figures agree with the results already obtained experimentally on other Railways as regards the impact effect due to the speed. The formulæ given in this report show that at high speeds the impact value can reach that of the static load of the various parts of the vehicle.

It would appear, therefore, desirable to carry out direct measurements of the actual stresses set up by the vehicles in the track under as varied conditions as possible, as this field is very wide and still unexplored; these experiments should make it possible to record the effects and all the consequences of the behaviour of old and new vehicles when running at speeds amply equal to those at which they are to be used.

3. *Vehicles running over curves at high speeds.*

The information received from the various Administrations shows that train speeds have markedly increased in the last years on some of the Railways. The limit of 120 km. (75 miles) an hour currently reached for a long time is now well exceeded. The speed towards which it would seem electric or steam trains are tending is 140 km. (87 miles) an hour, already worked to on some Railways.

Moreover, it appears to be an established fact that railcars and rail motor trains can be authorized to run at speeds above those authorized for ordinary trains running over the same lines. The maximum speed for such stock is at the present time 160 km. (100 miles) an hour for the Reichsbahn motor trains.

The different reports do not give, in support of the figures quoted, any detailed information as to why the various Railways consulted have allowed higher speeds than those they allowed in the past. Most of them seem to have carried out preliminary tests and to have fixed these new speed limits as the results of tests up to speeds which have been considered permissible on each line or section of line affected.

None of the reports give the determining reasons as regards the strength of the track and the general maintenance methods nor as regard the improvements or alterations which should be made or could be made in these two fields.

On the other hand, the construction and location of the track often determine the maximum permissible speed. These factors, which vary widely from one Railway to another, take into account the radii and superelevation of the curves and their transitions.

The maximum superelevation on a curve varies according to the Railways and is generally in the neighbourhood of 150 mm. (6"). In very exceptional cases

it is 200 mm. (8"). The maximum permissible speeds under these conditions then depend only on the radius of each curve and the strength of the track to stand the lateral thrusts of the wheel flanges, whilst providing the required comfort inside the vehicles.

In this connection, the very full study of the subject given in Mr. LEMAIRE's report should be mentioned.

The object of this investigation is to ascertain the proportion the centrifugal force is actually reduced when running through a curve at a given speed, by the layout and the superelevation. It also develops a method for comparing the values of the wheel thrust on the rails in the different cases investigated, taking into account the rules given by some Railways. It also leads to an examination as to what extent the proportion of the fast trains and slow trains should be taken into account when deciding the superelevation most suitable for the traffic and for the preservation of the track.

* * *

CHAPTER II.

Construction and modernization of the lines to carry heavy loads moving at high speeds.

Each of the three reports contains a detailed report of the actual form of construction of the main lines of the Railways consulted on this matter.

We pointed out previously that these did not appear to have shown clearly the real effect of the permanent way equipment on the heaviest loads and highest speeds allowed on their lines.

The principal elements which have a real influence on this matter nonetheless appear to be :

— *the weight and section of the rails and the type of joints used.*

The heaviest rails used to any extent

weigh about 75 kgr./m. (150 lb. per yard). The average weight of the rails laid on the main lines is about 50 kgr./m. (100 lb. per yard).

Mr. LEMAIRE's report reviews the data on which the periodical rail renewal programme on his Railway is based.

There are a great many designs of fish-plated joints and they differ much in practice. The use of long rails, which appears desirable in order to reduce the number of joints, i.e. the weakest points of the track, has not yet been used to any very great extent, nor is the practice at present entirely satisfactory.

— *the sleeping.*

Lines which may be run over at very high speeds are almost exclusively equipped with wooden sleepers. The number of sleepers per unit length of track is very high on the American Railways, where there are quite frequently some 2 000 per km. (3 200 per mile). On most other Railways there are about 1 800 per km. (2 880 per mile) on the most heavily stressed lines.

On Railways on which the highest speeds are practised with heavy loads, the rails are laid directly on the sleepers only in a few cases, sometimes with a rubber packing between the rails and the sleeper. All the other Railways on their heavily loaded lines use a metal bearing plate between the rails and the sleeper.

The laying plans show a tendency to leave between the two lines of rails only sufficient clearance to allow the two flanges to pass freely, with very little play. A good many Railways retain the normal gauge, i.e. that for straight sections, on curves with radii down to about 300 m. (15 chains).

— *the depth and kind of ballast.*

The track is laid on ballast 30 to 50 cm. (12" to 20") deep. The dimensions of the ballast generally used is approximately between 20 and 70 mm. (8" and

2' 3 1/2"). Broken stone, natural or artificial, seems to be the best material for ballasting heavily loaded track.

From the various information collected and classified in the three reports, it seems that the modernization of existing track for higher speeds and heavier loads usually involves the progressive strengthening of the existing track to bring it up to the same standard as that of the track laid recently on the most modern practice. Thus, the rails are replaced by heavier ones of higher tensile strength, sometimes heat-treated by a suitable method. The sleepers are increased and also the depth of the ballast, the latter being made homogeneous by using materials of the same size and character. No Railway has reported any important modification in the regulations and present methods of maintaining the track.

* * *

CHAPTER III.

Points and crossings run over by heavy loads moving at high speeds.

The general rule is not to limit the speed over the points and crossings when the through road is straight.

On the other hand, only a very few Railways allow these appliances to be run over unto a branch at high speed. None of them at the present time allow trains to run at more than 120 km. (75 miles) an hour under these conditions.

The length of the point blades now reaches some 15 m. (50'). The articulation is obtained by the pivoting of the heel, the end of which is held by a suitable fish-plate arrangement.

The layout of the track section connecting the points to the crossing has been studied with particular care. It usually consists of a curve of as large a radius as possible, making it possible to deflect gradually to the crossing the vehicle which has run over the point.

Therefore, the total length of the points and crossing sometimes exceeds some 60 m. (197').

It still appears impossible to appreciate, from the information supplied by the Railways using points which can be taken at high speed, the actual importance of the angle of deflection or incidence of the switch blade as regards the stresses set up in the vehicle running unto the point of the blade. This angle is often about 30', and only below this figure in very few types of switches.

Be this as it may, from the moment the vehicle takes the direction of the deflected route, it should be taken as far as the crossing by means of a curve of large radius. From the information contained in the reports there are in use only a few turnouts in which the switch is connected to the crossing by a curve of a radius of about or exceeding 1 000 m. (50 chains).

In one case the layout forms, starting from the point, a parabolic transition preceding the curve leading to the crossing.

As regards the crossing, the intersecting angle of the two rails, from the information received, is never less than a little below 3° (tan 0.05).

Most of these appliances have monoblock crossings in special cast steel. Some Railways are fastening the rails forming the points and crossings to metal bearing plates by autogeneous welding. The object of this is to get a strong and rigid assembly. The arrangement assists in protecting the whole of the points and crossing against deformations, which is essential if the vehicles are to run through them smoothly at high speeds.

The report of Messrs. YAMADA and HASHIGUCHI gives a certain number of details about special types of points and crossings designed to reduce the shocks and reactions between the wheels and the points and crossings when the vehicles run over the latter at high speeds.

Whenever possible the Railways give the turnout a suitable superelevation according to the radius of curvature of this turnout and the speed at which it is run over, taking into account the local layout and the way the turnout is connected to the running road.

Naturally points that have to be taken at very high speeds are provided with all modern safety devices securely locking the blades into the position in which they should be when the wheels are running over them.

* * *

Summary.

After having briefly epitomised the particular points of the very complete reports sent us, we think the following summaries can be drawn therefrom :

I. Except on the Railways in North America, where the axle load reaches 35 tons, the general limit is 20 tons. The tendency of the rolling stock designers at the present time is to make it 20 to 25 tons, according to the Railways concerned.

The speed of 120 km. (75 miles) an hour, the usual maximum for a long time for passenger trains, has been exceeded in many cases. The tendency at the present time is to authorize speeds of about 150 km. (93 miles) an hour for ordinary trains, and 160 km. (100 miles) an hour for railcars and rail motor trains.

Under these conditions the track stresses will henceforth include an increasing part due to the dynamic effects of the loads moving at high speeds. It is desirable, for this reason, that these dynamic effects should be investigated by means of experiments, tests and measurements in all the fields in which they may show themselves, both to guide the builders in finding suitable ways of balancing and distributing the forces,

and to appreciate the stresses the track must be effectively able to stand.

II. The heavy loads and high speeds impose upon the present-day rail metal a stress which in most cases it would be difficult to increase without affecting the behaviour and life of rails.

The weight of the rails on the most heavily loaded lines in Europe is about 50 kgr./m. (100 lb. per yard). There are still differences of opinion as to the desirability of increasing the weight of the rails to meet the increasing stress resulting from the loads and speeds.

The length of the rails and the types of rail joint vary much, according to the Railways. The conditions of use of extra-long rails are still under investigation and cannot be determined exactly at present.

III. The wooden sleeper is the most suitable for very high speeds. Increasing the sleepers is one of the methods which contribute to the strengthening of the track in order to enable it to carry the heaviest loads with the least damage.

Vehicles running at high speed under satisfactory conditions as regards comfort and safety require the track to be perfectly level as well as in good alignment and correct to gauge. These conditions can only be fulfilled if the fastenings securing the rails to the sleepers are perfectly maintained and tightened up. The use of bearing plates between the rails and the sleepers, with suitable fastening devices, is the general practice on many Railways and appears desirable, at least in those parts of the track which include curves of small radius.

IV. By increasing the depth of the ballast, the loads can be better distributed on the track. The ballast should be homogeneous and of good permeability, and consist of broken stone, the dimensions of which should not exceed 6 to 7 cm. (2 3/8" to 2 3/4").

The roadbed should be sound and properly drained to prevent water remaining on the ground in cases in which its permeability is known to be poor.

V. Advantage should be taken of the opportunity offered by track overhaul or renewal work, for modernising old track and obtaining the conditions stated above.

The alignment and levelling up of the track should be perfect in view of the speeds now run. Curves and their transitions should be very carefully laid, and be maintained and corrected as often as necessary.

VI. The angle of divergence at the point of the blade should be as small as possible; the blade should be flexible, so as to give the track a progressive curvature when entering the switch.

The radius of curvature of the part of the track connecting the switch to the crossing should be as large as possible to guide the vehicle up to the crossing.

All causes of shock or interruption in the running surface and guiding of the axles should be avoided by a careful layout of the whole of the points and crossing and of the two lines of rails.

The crossing angle should be as small as possible and the crossing, like the whole appliance, should be rigid and remain perfectly secure.

The superelevation of the curved parts should be computed in each particular case, according to the rules applying to the running road. The speeds to be allowed should be fixed and checked by tests with the various types of vehicles that have to be used.

QUESTION II.

Use of welding :

1. to obtain extra-long rails ;
2. in manufacturing and repairing points and crossings.

- a) Results obtained by using extra-long rails. Methods used to ensure safe expansion of the rails and anchoring of the track.
- b) Technical and financial results shown by welding points and crossings,

by Dr.-Ing. MÜLLER,

Special Reporter.

This special account sums up the three reports drawn up on the above Question, by Messrs. :

G. ELLSON ⁽¹⁾ (Great Britain, Dominions and Colonies, India, North and South America, China, Japan);

J. RIDET ⁽²⁾ (France and Colonies, Spain, Portugal and Colonies, Italy, Czechoslovakia, Bulgaria, Rumania, Jugoslavia, Greece, Turkey, Egypt);

Dr.-Ing. MÜLLER ⁽³⁾ (Germany, Belgium and Colony, Luxemburg, Netherlands and Colonies, Denmark, Norway, Sweden, Finland, Poland, Austria, Hungary, Switzerland).

These papers all agree in reporting the use of welding for :

- (a) obtaining extra-long rail lengths;
- (b) manufacturing permanent - way parts;
- (c) reconditioning permanent - way parts.

(1) See *Bulletin of the Railway Congress*, January 1937, p. 1/27.

(2) See *Bulletin of the Railway Congress*, January 1937, p. 171/99.

(3) See *Bulletin of the Railway Congress*, November 1936, p. 1239/1.

A. — Welding rails together to obtain longer lengths.

Rails were welded together for the first time in 1906. This was a case of tramway rails with which track deformations are little to be feared as the rails are buried in the roadway, the rail temperature variations are small, and the running speeds low.

The conditions in railway lines are much less favourable and the Railways hesitated for a long time to weld rails into longer lengths. In 1906, the French Nord Railway carried out trials by thermit-pressure welding 28 rail joints. When, owing to wear, these rails were withdrawn in 1935 after 29 years service, not a single weld had failed. The Nord continued to experiment in subsequent years. In 1924, the Deutsche Reichsbahn commenced to make tests. Most of the other Railways started to weld rails together between 1927 and 1933. The diagram in Mr. RIDET's report shows the yearly growth in the number of welded rail joints.

The Deutsche Reichsbahn leads at the present time as regard the total *length of track laid* with welded rails (6 200 km. = 3 852 miles).

The second place is taken by the Belgian National Light Railways Company with 950 km. (590 miles), followed by the Polish State with 600 km. (373 miles), the South African Railways with 195 km. (121 miles), and the French Nord with 183 km. (112 miles).

The length of long rails obtained varies between very wide limits. In running roads the welded rails generally used are 20 to 83 m. (66' to 272') long. Some Railways have laid for test purposes very long rails without joints. The Delaware and Hudson Railroad has welded up to 2 103 m. (6 900'), the Bessemer and Lake Erie 1 600 m. (5 250'), and the Egyptian State and Reichsbahn 1 000 m. (3 280') lengths in their main lines. On bridges, 450 m. (1 475') lengths of welded rails are in use on the Göteborg-Boras-Alvesta Ry. In tunnels, the Reichsbahn has welded a continuous length of 2 000 m. (6 560'). The tables included in the three reports give information on the length of track with welded rails on the different Railways. In this connection, the carefully prepared table given as an appendix to Mr. ELLSON's report, reproduces very completely the replies of the Railways to the different questions.

The Railways do not object to the use of welded rails on the main lines on curves of as small a radius as 180 m. (9 chains) nor to letting high-speed locomotives with heavy axle loads working a heavy traffic run over lines made up of long rails. The highest speeds in this case are 120 to 160 km. (75 to 100 miles) an hour in Europe, and the maximum axle load 20 to 22.5 t. (19.7 to 22.1 Engl. tons). In the United States, two Railways using welded rails, namely the Delaware and Hudson Railroad and the Bessemer and Lake Erie Railroad, report a maximum speed of only 72 km. (45 miles) an hour, whereas the maximum axle load is 35 and 34 Engl. tons.

Weight of rails : 65 kgr. per metre — (130 lb. per yard), average distance apart of sleepers 54 cm. (1' 9 5/16"), and 42 cm.

1' 4 1/2"), at the joints; ribbed sole plates with fastenings independent of the rails and of the sole plate to the sleeper. This is consequently a track which is sufficiently strong to prevent creep and deformation, so that 83 m. (272') long rails can be assembled by means of ordinary fish plates, like the ordinary standard 12-m. (39' 4 1/2") rail.

The *welding processes* used for extra long rails are the following :

- (1) thermit welding;
- (2) electric resistance welding;
- (3) electric butt welding;
- (4) electric-arc fish plate fillet welding;
- (5) oxy-acetylene or autogenous welding.

Thermit welding, pressure or fusion, is so far the most usual method employed on most Railways throughout the world. The reports by Mr. RIDET and Dr. MÜLLER give detailed information on the particular features of these two methods of welding. With fusion welding there is in the rail head a mass of foreign metal several centimetres wide which can cause the formation of fissures through shock; this drawback has been overcome by combined pressure-fusion welding with pre-heating.

Electric resistance welding, details of which are given in the reports by Mr. RIDET and Dr. MÜLLER, is being used more and more. Some Railways prefer this method to all others. The Delaware and Hudson Railroad has perfected an equipment with which electric resistance welding can be carried out on the track itself.

Electric butt welding has been resorted to as experiment by some Railways. The tests made by the Reichsbahn with this process, as reported in detail in Dr. MÜLLER's report, have been unsatisfactory; this Railway, consequently, has not adopted it. Recently the Swiss Federal

Railways, the Czechoslovak State Railways, and the Piedmontese Tramways, amongst others, have carried out further trials with this process.

Fillet welding of fish-plates has been used so far on quite a large scale — 250 km. (155 miles) — by the Belgian National Light Railways Company, and by the South African Rys. (21 000 rail joints). The number of broken joints with this method is rather high. The Japanese State Railways have also carried out experiments with fillet welded fish plates, and report that the results were not so good as those obtained by electric resistance welding.

Autogenous welding is being tried at the present time by some Railways. Consequently no opinion on the advantages and disadvantages of this type of weld can be expressed.

In the case of autogenous welding the rail joints are nearly always of the « complex » design, i.e. they incorporate fish plates, bearing plates, etc. This seems to suggest some lack of confidence in this type of welded joint.

It can be seen that in the present stage of evolution, thermit welding and electric resistance welding are the chief types to be considered when welding rails into longer lengths. The thermit process does not involve much equipment and its cost can be distributed over a few welds. Thermit welding can be done anywhere, as for example on the track itself. It is the most economical form of welding when there are a very small number of welds to be made at a given point. Electric resistance welding is not so economical unless the high cost of the equipment and accessories can be distributed over a large number of welds (some 10 000 at least). With the thermit process rails of appreciably different section can be welded together, whereas resistance welding requires the sections to be more or less the same. Consequently with thermit welding it is possible to connect the rails together, and avoid the use of cranked fish plates.

Some Railways consider *heat treatment* of welded rails as necessary. The French Railways are at the present time carrying out tests of welds on hardened rails. When the thermit-fusion weld is completed, the weld is annealed by a patented method and the surface of the rail head then cooled by spraying water on it. The London Passenger Transport Board, the Japanese Government Railways and the Delaware and Hudson Railroad anneal the rails after welding, by means of oil-fired portable furnaces or a blow pipe, or electrically. The other Railways do not consider it necessary to anneal welds.

The *welds are made* either by the railways themselves or by contractors. The general tendency is to send railway staff to follow special welding courses or to have them trained by firms specialising in welding, until they may work on their own.

The number of *broken welded joints* is very small relatively to the total number of welded joints in service. In the case of thermit and electric resistance welding, these fractures are nearly always attributable to defective work by insufficiently trained staff. They usually occur in the earliest sections of line welded, and soon after the welded rails have been put into use. Some Railways consider that the cause of the fractures is to be found in fine cracks starting from the fish-plate bolt holes. For this reason the ends of the old rails are now generally cut off so as to remove the fish-plate bolt holes and the worn ends. The highest proportion of breakages has been found in the case of electric fillet-welded fish plates. In order to reduce the number of broken rails, the Railways watch the welding very carefully. When in the track, welded joints are not subjected to any special supervision.

On all Railways a percentage of welds is tested, in various ways: static bending tests in a press, fatigue bending tests under continuous and alternating load, tensile tests, resilience tests, Brinell hard-

ness test, examination of the structure, etc. In order to reveal any cracks in a welded joint, the present method is to examine the joint by sprinkling very finely divided iron powder over the magnetised surface of the part. Radiography too, has been used to reveal internal defects, such as blow-holes and cracks. In the United States of America the examination of the condition of welds is frequently completed by the use of the Sperry detector. The different test methods with drawings, photographs and tables, have been dealt with at length in Mr. RIDET's report.

The Railways do not agree as to the method of calculating the *joint (expansion) gap*, or more exactly the opening to be left at a given rail temperature when laying the rails. Undoubtedly the local climatic conditions play an important part in fixing these gaps. Generally speaking, rails exceeding 24 m. (78' 9") in length must be considered as being in compression or tension. The gap varies with the constraint due to the friction of the fish-plates, the friction of the rails on the sleepers, and of the sleepers on the ballast, and the method of packing between the sleepers. According to the way the fish-plates are assembled and fastened to the rails, the rail fastenings, and the nature of the ballast, these constraining forces, which oppose any alteration in the length of the rails, vary enormously. In view of this frictional resistance, the same or slightly greater expansion gaps are provided in the case of long welded rails as in the case of rails of ordinary length. The joints between welded rails are nearly always assembled with the usual type of fish-plate; only on bridges and other structures and when exceptionally long lengths of welded rails, exceeding 120 m. (400') are used, some Railways provide special expansion devices. The usual sleeper spacing as a rule is not altered for very long rails, although some Railways reduce it slightly near the welds.

In order to increase the frictional resistance between the sleepers and the ballast, broken stone is used most often, or quarry chippings, unless the local conditions make it necessary to use gravel.

Mr. RIDET in his report gives the normal ratios between the joint gaps, the length of the rails, and the frictional resistance. He also mentions the difference, already pointed out by Dr. MÜLLER, between the joint gap and the gap as laid.

The *precautionary measures taken to prevent track deformations* are the following : anchoring the track to prevent it lifting, sleepers strengthened between the rails with short lengths of rails, special security devices on curves, widening or increasing the depth of ballast, embedding the rails in the ballast. Most of the Railways, however, consider that no special steps are necessary, but that the best method of preventing the rails creeping and the track buckling, is to see the rails are securely fastened to the sleepers and to use broken stone ballast.

The reports give no information how far the various measures taken prevent the from track buckling, nor whether the track still buckles in spite of these precautions.

The *cost of welding* depends upon the process used, the number of welds to be made at one place, the local conditions, the working conditions, the local rates of wages, and finally the various outside conditions affecting the work. The cost of a thermit weld is generally at least four times that of a simple fished joint. In spite of this, the economic value of welding is not queried by any Railway; this is because the cost is made good by appreciable advantages and by various savings which it is still impossible to calculate as the length of line laid with long welded rails so far is a very small proportion of each Administration's lines.

The Railways all agree in reporting the smooth and steady running obtained

when very long rails are used and the greater comfort they mean for the passengers. Besides, a century's experience has taught us that the rail joint is the weak point of the track, as it makes a break in the carrying and guiding rail. The small varying gap at the joint has a very bad effect on the track. For this reason any reduction in the number of fished joints and therefore of the points where shocks occur is very beneficial for the rest of the track. The use of long rails *reduces the maintenance costs*, not only of the joints themselves, but also of the track as a whole. The tendency of short rails to buckle at the joints on curves and to disturb the alignment of the track is avoided. The life of rails is increased thereby and other appreciable savings as regards rail renewal are obtained. As each fished joint reacts unfavourably on the wheels and vehicles, a reduction in the number of such joints will result in a reduction in maintenance costs of rolling stock, lengthen the life of the latter and consequently save renewal costs.

Rail creep will be reduced with many types of track, resulting in further savings being effected.

On electrified lines the welded joints need no longer be bonded. In some countries, such as the U.S.A., where relatively short rails are still used, large numbers have to be removed prematurely because of excessive batter of the rail ends. By reducing the number of fished joints, the life of these rails in the track will be increased considerably. Whereas previously the ends of the rails had to be cut away, thereby reducing their length and increasing the number of fished joints before they could be used on secondary lines, two or more old rails can now be welded together and the number of fished joints reduced.

All these advantages have led most Railways to extend the practice of welding rails, whilst endeavouring to develop and cheapen the different welding processes.

B. — Application of welding to the manufacture of permanent-way parts.

Welding is used to an increasing extent in the construction of points and crossings, and steel sleepers, the processes resorted to being :

- electric fillet welding;
- autogenous fillet welding
- electric spot welding.

Since 1929, the French Nord has put into use more than 2 000 welded switches and crossings. Crossing noses and obtuse crossings have been manufactured and check rails have been welded to continuous base plates, and sliding chairs to the bearing plate. These points and crossings are used in sidings, harbour roads and locomotive depots, as well as in station sidings. As regards the noses of the crossings, special rails with a 97 mm. (3 13/16") wide foot are used, as this facilitates running the weld fillets in the angles between the nose and the wing rail.

As the different parts frequently get out of shape during cooling, some Railways overcome this drawback by cambering the part in question an equivalent amount in the opposite direction before welding. Arc welding with coated electrodes 5 mm. (3/16") in diameter is the process used.

According to the French Nord, the technique of welding points and crossings has now been so perfected that practically no trouble is experienced. The welding is done by men employed by the Company in its own workshops. Welded crossings are slightly dearer than the usual built-up assembly, but a good deal less than cast manganese steel crossings, and have none of the defects of cast steel (internal stresses, segregation, piping, moulding defects). The French State Rys. use crossings welded to a base plate, fabricated in the same way as on the Nord. The Rumanian State Rys. have obtained good results with an all-welded

acute crossing. The Czechoslovak State Rys. have welded points and crossings to simplify the construction and especially to strengthen it. The Alsace-Lorraine Rys. strengthen the crossings by welding the foot of the rail to a heavy base plate, whilst retaining the usual assembly with distance pieces, bolts and clips. Special mention should be made of the tests carried out by the *Acieries de la Chiers* (Meurthe-et-Moselle, France) with crossings made from 12 % manganese steel rails, planed and welded together. With this method of construction the distance pieces are made from 15 mm. (5/8") thick plate welded into position in place of the bolted distance pieces. These Works hope to get as good results with the welded manganese steel crossings as with cast manganese monoblock points and crossings. Mr. RIDET's report gives very full details, drawings and photographs on the fabrication of these points, to which we would specially refer.

Points and crossings by welding have been manufactured as a trial by the Bombay, Baroda & Central India Railway.

The Japanese Government Rys. as an experiment have fabricated points and crossings welded to strengthening plates, by spot welding or fillet welding. Though the results were not entirely satisfactory, these two Railways are continuing their trials. On the South African Rys. welded wide-angle obtuse crossings at the crossing of a railway line and a tramway give better results than bolted crossings; in addition, their cost is much lower. Details and drawings illustrating the use of welding by the last three Railways are given in Mr. ELLSON's report.

To judge from the work done and the results obtained, the application of welding to the construction of permanent way materials will probably increase.

A large field open to welding is in the manufacturing of metal sleepers. On the Reichsbahn, the ribbed sole plates or sliding chairs are arc-welded by fillet

welds on all new steel sleepers. The Hungarian State Rys. follow the same practice, whilst the Swiss Federal Rys. are satisfied at the present time with welding the sliding chairs of their new design of points and crossings. The Belgian National Rys. Co. uses welding in fabricating all new metal sleepers, and has given very detailed descriptions of the fabrication, inspection, and testing of these sleepers.

In Great Britain arc welding with coated electrodes is used for welding the chairs to metal sleepers. These sleepers have given good results from every point of view. At the present time there are about 44 000 in service. In addition, attention should be called to the metal sleepers on the Delaware and Hudson Railroad, fabricated since 1926 from old rails, fish-plates, and bearing plates. These latter are welded to the heads of two 2.44-m. (8') long pieces of rail, and angle fish-plates are welded across the end to connect the sections of rail and prevent transverse movement. Such sleepers, which carry axle loads of some 35 Engl. tons, have been laid in sidings, to the number of 118 000. So far no defects have been recorded. Drawings of this English welded sleeper and the American sleeper are given in Mr. ELLSON's report. Mention should also be made of a Czechoslovak method which consists in fillet arc welding to the metal sleepers the blocks upon which the clips bear, to ensure the coach screws being stressed vertically only. These sleepers, described in Mr. RIDET's report, give good results.

Parts of the points and crossings and metal sleepers are tested by various methods : drop test, bend test, examination of internal structure. The Reichsbahn examines the welded joints as regards the union of the metals and the depth of penetration. The British Railways examine the structure of the metal and chemical composition of the electrodes.

Welding has stood the test of exper-

ience in the fabrication of permanent way materials, and most railways intend to extend its use.

C. — Application of welding to the reconditioning of permanent way parts.

This is chiefly a question of *building up worn parts to their original section by welding*. The Pennsylvania Railroad started building up battered rail ends in 1918, since when this Railway has treated about 2 400 miles of track in this way. Other American Railways have followed suit; for example, the Delaware & Hudson Railroad has built up 115 500 rail joints in this way, and the Long Island Railroad applied the process to about 60 miles of line. En Europe, the French Nord build up the ends of worn rails, and so far has repaired 2 000 joints. This practice of building up the worn rail ends has also been adopted by the Deutsche Reichsbahn, the Belgian National Light Rys. Co., the Swiss Federal Rys. and the Polish State Rys. The process, moreover, is used not only for the rail ends but also when the running surface of the rails shows flaking and wear through skidding.

Electric arc welding is the process mainly used, although recently autogenous welding has been gaining ground.

On all Railways the widest use of building up by welding is for *reconditioning points and crossings* owing to the rapid wear of the crossing noses, the wing rails and the point blades.

As the *noses* and the *wing rails* undergo much heavier wear than the blades, nearly all the Railways for many years have built up these parts by welding. The experimental stage has already been passed on a number of Railways and welding has become standard practice.

The British Railways distinguish themselves by the extent to which crossings have been reconditioned. The Southern Ry. has built up 17 500, the L.M.S. 14 000, the L.N.E.R. 8 500, and the Great West-

ern 6 100 in this way. The South African Rys. have already dealt with 3 600 crossings by this method. In the United States of America crossings have not been built up by welding to the same extent as worn rail ends. The Baltimore and Ohio Railroad, however, has built up 1 700 crossings, and the Delaware and Hudson Railroad 1 200.

Most of the European Railways recondition the parts by electric welding, but the number of welds made is not yet available. Only the French Nord reports that it has reconditioned 1 800 points and crossings by building up the worn running surfaces. The Alsace-Lorraine Rys. have dealt with 3 000 points and crossings. In 1926 the Reichsbahn carried out trials to recondition noses and wing rails, originally by arc welding, and since 1934 by autogenous welding. The welding was done both in the workshop and on the track. Autogenous welding can be used anywhere and on the line without outside power or heat source. Whereas on the Reichsbahn both welding methods gave satisfactory results, some French Railways call attention to the fact that autogenous welding involves the provision of a large stock of gas cylinders, necessitates greater precautions, requires more experienced workmen and is more costly.

The result of the general enquiries is that reconditioning worn parts by electric arc welding is the more usual practice. Autogenous welding has come into more general use only recently, and some Railways, in the United States for example, are employing it more and more. In the present state of knowledge, the particular suitability of any one process for reconditioning cannot be decided.

The buiding up of point blades has also been undertaken on a large scale, especially in the United States and Great Britain. Other Railways, such as the Deutsche Reichsbahn, the Belgian National Rys. Co. and the Japanese Government Rys. have adopted this practice.

The only test of the weld metal in use is the Brinell hardness test. In special circumstances, as for example, defective welds, drop tests and analyses of the structure are made.

Reconditioning by welding as a rule is done departmentally, by staff specially trained in this class of work.

In most cases, the Railways consider that the reconditioned parts give as satisfactory results as new parts. Few Railways have been disappointed with the results: they hope to be able by further trials and sufficiently longer experience, to effect financial savings. Generally speaking, the Railways intend to continue reconditioning by welding, and to extend the practice. For example, joints can be reconditioned by building up the angle fish plates — this has been done on a few Administrations, including the Reading Railroad, — or by building up, as suggested by Mr. RIDET, the fishing surfaces by means of added metal. Possibly reconditioning by welding might be applied to the heavily worn outer rails on curves. The importance attached by the Railways to reconditioning by welding is shown in the three reports, which give many details worthy of attention.

For *reconditioning old steel sleepers*, electric resistance welding seemed likely to succeed. On the Reichsbahn, since 1923, the usable middle parts have been cut out of the old steel sleepers and welded together to make new sleepers which are drilled and notched like new ones. As reconditioned steel sleepers have met all requirements, the number of such welds is steadily increasing. Relatively to the price of new sleepers, the cost of reconditioning old sleepers gives an appreciable saving.

The Polish State Rys. have obtained good results by welding old steel sleepers by the electric butt welding process and by autogenous welding. The Hungarian Rys. which have used steel sleepers in the running roads only since 1931, recondition by arc or autogenous welding old

branch line sleepers by welding the cracks, welding on new bearing plates, or cutting out the old cracked bearings and replacing them by welding new ones into place. This Administration also has effected savings in this way.

The Deutsche Reichsbahn uses welding on a large scale for reconditioning old switches and crossings. For this purpose electric butt welding is used for the following operations: connecting the pivot with the heel of the blade, assembling shortened switch blades, reformed to the normal rail section, with the connecting rails, connecting worn points made from standard rails with short lengths of rails for acute or obtuse crossings, connecting check rails, stock rails and acute crossings, assembling the noses of forged crossings with the connecting rails. The electric arc fillet welding process is used to weld ribbed plates and sliding chairs to metal sleepers or the base plates of points and crossings. The crossing noses, wing rails, switch blades and heels, and locking gear can be built up by welding (electric or autogenous). Welding is used to recondition old permanent way materials in order to reduce the number of rail joints in the zone of the switches, reduce the number of bolted and riveted assemblies, and finally to lighten as much as possible shocks from the wheels passing over the flange grooves which interrupt the running surface.

The reconditioning of old points and crossings by welding has given excellent results and has effected savings in the first cost and in the maintenance costs.

* * *

Resume.

Welding is used:

- (a) to obtain extra long rails;
- (b) to fabricate permanent way parts;
- (c) to recondition (built up) permanent way parts.

A. — Welding rails together to obtain longer lengths.

The use of welding to obtain extra long rails was introduced between 1927 and 1933 on most railways, and has been extended from year to year. Various Railways already possess lengths of track varying from several hundred kilometres up to nearly 1 000 km. (620 miles) laid with welded rails; on the Deutsche Reichsbahn the total length of track with long welded rails is already 6 200 km. (3 852 miles). On ordinary running roads the length of welded rails varies between 20 and 83 m. (66' to 272'); however, several Railways have laid rails 1 000 m. (3 280 ft) long and over. On bridges and in tunnels, rails of 450 and 2 000 m. (1 475' and 6 560') respectively, are found. The use of extra long rails involves no risk, neither in curves of as little as 180 m. (9 chains) radius, nor on main lines with heavy traffic, high speeds and heavy axle loads. Extra long rails are obtained by welding rails together by the following processes :

- (1) thermit welding;
- (2) electric resistance welding;
- (3) electric arc butt welding;
- (4) electric arc fish-plate fillet welding;
- (5) autogenous welding.

The welding processes most used are thermit and electric resistance. Thermit welding can be used anywhere on the track. It also allows of rails of different sections being welded together (transition rails). Whereas with this process good economic results are already obtained when a few welds have to be made at a given point, with electric resistance welding a great number of operations are required to be made on account of the high first cost of the welding plant. Thanks to the quality of the weld, the latter process is, however, being used on an increasing scale. As to the electric arc welding and autogen-

ous welding processes, they are only used by a few Administrations, and generally in the cases of track accessories such as bolts, fish-plates, bearing plates, etc.

Some Administrations are in favour of heat treatment of welded rails.

As far as possible, welding work is carried by the railway staff familiar with the welding technique.

With thermit welding and electric resistance welding, the number of rail breakages is very low as compared with the number of welded joints in service. The breakages are nearly always attributable to the welds having been badly made, especially in the case of the first rails dealt with. Fish-plate arc welds up to now show a relatively high proportion of breakages.

Most Administrations test a percentage of the welds for quality, by different methods.

When computing the expansion gap for a given rail temperature, local climatic conditions should be taken into account, as well as the constraining forces due to the friction of the fish-plates, friction between the rails and the sleepers and between the sleepers and the ballast, and the nature and kind of ballast between sleepers. Special precautions against buckling of the track are taken by some Railways. Most Administration are of the opinion that a good fastening of the rail to the sleeper and the use of broken stone ballast are the best means of preventing rail creep and track buckling.

The cost price of welding depends on the process used, local circumstances, operating conditions, wages paid in the district concerned, and on various factors which may affect the actual welding work.

The cost price of a welded rail joint is appreciably higher than that of a fished joint; this is compensated for by considerable advantages and savings.

The tendency is generally noticed to extend the use of welding to obtain extra long rails. On the other hand, an endeavour is being made to perfect the various

welding processes and to improve them from an economic standpoint.

B. — Application of welding to the manufacture of permanent-way parts.

The welding processes used are :

- (1) Electric fillet welding;
- (2) Autogenous fillet welding;
- (3) Electric spot welding.

Electric fillet is the process most used. Different Railways have used it to fabricate crossing noses, obtuse crossings and point blades. Furthermore check rails have been secured to continuous base plates by welding, and sliding chairs have been welded to the point bearing plate.

Good results are mostly obtained with welded permanent-way appliances. Even Railways who have not been quite satisfied carry on their experiments.

Welding has proved very useful in the fabrication of steel sleepers. Fillet welding of ribbed sole-plates or sliding chairs has been used on an increasing scale in Germany and in Great Britain.

C. — Application of welding to the reconditioning of permanent-way parts.

Among the operations performed to recondition track components, building up by welding, thus restoring the original contour of worn parts, should be mentioned first.

Building up by welding is applied on a large scale, especially in the U.S.A. for reconditioning battered rail ends. Several Railways also use the process for restoring the running surface of rails to standard dimensions. Besides electric arc welding, which is the most used, autogenous welding has been adopted more and more for some time past.

Building up crossing noses, wing rails and switch blades by welding has also given good results. On many Railways such welding work is resorted to on a large and ever increasing scale. In this

case also autogenous welding has begun taking its place besides electric arc welding. Several Administrations have also built up worn point blades by welding. The most general opinion is that parts reconditioned by welding give as good service as new parts.

In order to be able to re-use worn steel sleepers, several Administrations, especially the Deutsche Reichsbahn, cut the still serviceable middle parts of old sleepers and make new complete sleepers therewith by electric resistance welding.

The various welding processes have proved very profitable for reconditioning old points and crossings. While by electric arc butt welding it is possible to assemble all special parts shaped like rails, and which are run over by the rolling loads, and also check rails and the sleepers carrying the switches, it has been found that electric arc fillet welding is particularly suitable for securing ribbed sole-plates and sliding chairs to the steel sleepers or base plates. When parts particularly worn by the wheels, such as crossing noses, wing rails and point blades are reconditioned by building them up to original dimensions by welding, considerable savings in first cost and maintenance costs are effected.

D. — Summary.

The application of welding to track equipment, which only dates back about 6 years, has not only given rise, in spite of its recent introduction, to constructional progress, but, as shown by the results obtained so far, has been the means of effecting appreciable savings in the first cost and maintenance costs of the track.

The chief advantage of welding is that the number of rail joints can be markedly reduced, and that the joints can even be entirely eliminated on long track lengths.

It is desirable that studies and experiments be carried on in connection with

the behaviour of extra-long welded rails under the rolling loads, as well as the width of the joint gap with different lengths, at different rail temperatures. First of all, the exact causes of track deformations, which sometimes occur should be investigated.

On the other hand, not only is smooth and comfortable riding obtained by the use of extra-long rails, but there is also less wear and tear of the rolling stock. Consequently savings in the first cost and maintenance of rolling stock may be expected, such savings being the larger the longer the section of line laid with long rails. By the use of welding for assembling and fastening rails and other track components, particularly when fabricating points and crossings, it is possible to reduce the number of fastenings subject to heavy wear. The resistance to wear and the life of points

and crossings will be increased thereby. Finally, building up by welding is a means of reconditioning the worn running surfaces and consequently of again lengthening the life of rails and crossing noses. This results in still further savings on the capital cost and maintenance costs of the track as a whole.

As regards the various welding processes, which are still in the experimental stage, an endeavour is made, by means of observations, studies and experiments, to find out, for each kind of weld, which process is the best from the double point of view of quality and financial value. The results obtained in a short time are so promising that it is proposed everywhere to still further extend the use of welding in track work. There is every hope that future progress in this still new field, will prove beneficial for the Railway and their respective countries.

QUESTION III.

Methodical and periodical maintenance of :

1. metal bridges; 2. signals; 3. metal supports carrying the contact wire on electric railways.

Organisation. — Working methods. — Materials used,

by Th. W. MUNDT,
Special Reporter.

This subject was dealt with in three reports, drawn up respectively by Messrs. :

Wm. A. FRASER ⁽¹⁾ (Great Britain, India, Dominions and Colonies, North and South America, China and Japan),

V. DEGREEF ⁽²⁾ (Bulgaria, Egypt, Spain, France and Colonies, Greece, Italy, Portugal and Colonies, Rumania, Czechoslovakia, Turkey and Jugoslavia), and

Th. W. MUNDT ⁽³⁾ (Netherlands and Colonies, Germany, Belgium and Colony, Luxemburg, Denmark, Norway, Sweden, Finland, Poland, Austria, Hungary, Switzerland).

*
* * *

I. — Metal bridges.

The two following cases may occur :

— The Chief Civil Engineer is responsible for the design and construction of

steel structures as well as for the maintenance of such works;

— or else different Departments are responsible for construction and for maintenance.

As regards maintenance, a railway system is divided into Divisions or Districts, each of the latter being placed under the orders of an Engineer who is assisted, in most instances, by a bridge Inspector specially appointed for this service. This inspector has under his orders a special gang of men responsible for bridge maintenance (current upkeep) and who sometimes carry out light, and under certain circumstances, heavy repairs.

In cases where the Divisional Engineer has no such gang of men at his disposal, maintenance work and repairs are contracted out.

Maintenance of operating appliances of movable bridges worked by hand is attended to by the engineer responsible for the maintenance of the bridge itself; when it is a question of bridges worked by electricity, an internal-combustion engine or by steam, the electrical engineer or the mechanical engineer is responsible for their maintenance, but only as regards the power installation.

⁽¹⁾ See *Bulletin of the Railway Congress*, September 1936, p. 875/1.

⁽²⁾ See *Bulletin of the Railway Congress*, March 1937, p. 775/57.

⁽³⁾ See *Bulletin of the Railway Congress*, May 1937, p. 1245/43.

Periodical maintenance, such as derusting and painting, is carried out, according to circumstances, every 2 to 6 years; under certain climatic conditions, and when the atmospherical circumstances are particularly good, such intervals may be up to 10 years.

In the case of important or very large bridges, a special gang of men attends to structures of this sort and thus there is, properly speaking, no periodical maintenance, but rather continual maintenance.

In most instances it is the duty of permanent way inspectors to report any damage to bridges which they may ascertain, although a detailed inspection is not required from them.

The detailed inspection which takes place periodically and which, in certain instances, is divided into an annual inspection and a general inspection every 5 to 6 years, is carried out under the direct authority of the engineer in charge.

De-rusting work is done both by hand, or mechanically by pneumatic or electrical appliances; the latter method is being more and more used.

Electric welding is being more and more frequently used for repairing and for strengthening bridges; as a rule, coated electrodes are used, although bare electrodes are also employed.

Certain Railway Administrations own X-ray apparatus for testing welds; in other cases, when such tests are considered necessary, the Railways use appliances belonging to Public Authorities or to private firms.

Painting is done both by hand and by spraying, or else first by spraying and then finished off by brush. Opinions differ considerably as to which of the two methods be given preference. No instances have been encountered where paint containing white lead is applied by spraying.

As regards the ground coat, varying

compositions having red lead or iron oxide as a basis are used.

The composition of paints for the top coats — of which there are generally two — varies so much that it is not possible to express any recommendation in this respect. For surfaces that are much exposed to the action of moisture or fumes, bituminous paints are frequently used. Cases are also encountered in which such surfaces are coated with a layer of reinforced concrete 4 to 5 cm. (1 9/16" to 2") thick.

In most instances the outer coats are applied immediately after the derusting work has been done and red lead applied, although in the case of bridges of very large dimensions it also happens that these coats are only applied during the year following that in which derusting and red-lead painting took place.

As a rule, when re-painting work is done it is considered advisable to apply a new final coat to the whole surface. In certain cases, when repainting is done, undamaged parts of the structure are not given a new coat if it is considered that the paint already applied will provide sufficient protection for several years and that æsthetical reasons are not averse to there being a difference in shades.

On most Railways the derusting work and the application of priming coats are carried out departmentally, as also the application of the covering coats. However, the latter work, as the former are sometimes contracted out.

In order to ascertain the general opinion as to the advisability of removing the mill scale from steel intended for new structures, before applying priming coats and, at the same time be able to lengthen the period between two paintings, a question referring specifically to this subject was included in the questionnaire submitted to all the Railways.

Certain Administrations replied that, as the result of removing the mill scale, the period between two successive re-

paintings ought to be shortened; others, on the contrary, are of opinion that the removal of this scale in the case of new structures, has a favourable effect on the preservation of the paint.

In the case of large bridges the general rule is to place, beneath and alongside them, inspection trucks and (or) gangways along parts which would otherwise be difficult to inspect, these appliances facilitating both maintenance work and repainting.

Corrugated plates, which in the past were frequently used as a flooring between the rails and alongside the track, and which prevented water from running off freely, are now usually replaced by embossed or other similar plates from which the water can easily flow off. Flooring made of concrete slabs is also encountered.

Maintenance and painting of trough bridges carrying overhead electric conductors, as well as maintenance of bridges with a third rail (electric traction), is done in most instances when the current is cut off and, if possible, by day and between train intervals. If this is not possible, the current is cut off at night, and the maintenance and painting work done.

The circuits are opened and closed under the supervision of a man belonging to the electrical department, he alone being responsible and having to be present the whole time work is proceeding.

II. — Signals.

Maintenance of signals is usually carried out by a special Department. In only a few cases is this work done by the permanent-way staff, whilst cases are also encountered in which signal inspectors are attached to the respective districts of the Operating Department.

As a rule telegraphs, telephones and practically all means of electrical com-

munication are attached to the same Department. This applies in particular to countries having a very dense railway system, carrying heavy traffic. In countries with less busy lines, it is possible for telegraphs and telephones to be maintained by the Post Office.

The sub-division of maintenance services, moreover, varies much, especially as regards the extent and importance of more or less autonomous sub-divisions.

The number of operating levers varies considerably from one country to another. As a rule the number of mechanically operated levers is much greater than that of electrically operated levers. The average ratio of same, in the case of Administrations consulted, who have heavy traffic to handle, is 10/1. Systems operated otherwise than electrically or mechanically are not in general use.

The average number of operating levers per district is also quite variable. No useful purpose would be served by mentioning comparative figures here, because the circumstances clearly differ too much.

The 8-hour work day is generally the rule. The number of hours' work per week differs and is not always equal to 6×8 hours.

The method of reckoning the travelling varies considerably.

It is the usual practice to allow time off in lieu of overtime, within a given period, a week or a month.

As a general rule, a 10-hour day is not exceeded save on exceptional occasions such as accidents, etc.

The supervising staff is usually paid by the month and not by the hour. This staff does not receive any compensation for overtime when they have to turn out in an emergency even on Sunday and holidays.

The staff are generally given a practical training. Theoretical courses or special training periods lasting a given time do not exist except in certain isolated cases.

Promotion is by selection and to the extent that places become vacant.

Printed regulations for use by maintenance staff are not the general rule, although certain Administrations have such regulations or are drawing up same. Headquarters are kept informed as to work done by the supervisory staff, by means of periodical reports.

Although certain Administrations hold periodical examinations to make sure that their maintenance staff possess sufficient knowledge of the regulations, it is usually considered sufficient to verify this point from time to time during the course of the various duties performed by maintenance staff.

Lists giving the addresses of maintenance staff are usually displayed in signal boxes or in station-masters' offices.

Most Railways enforce written agreements with the Operating Department concerned when important work has to be carried out on points and crossings, etc. Such work is mostly carried out according to a programme drawn up beforehand. Locations where the interlocking between switches and signals is disconnected are in all instances pointed out by special warning boards.

Ordinary track workers are in no instance authorised to make any alteration to interlockings, for cleaning or for oiling. Alterations to interlockings are not allowed to be done, as a rule, except by staff specially appointed for this purpose.

As a rule, maintenance workers keep a small supply of materials, sufficient for their requirements during 1 to 3 months.

In cases where a stock of materials is kept in signal boxes, this stock is generally checked by a higher grade employee (usually an inspector).

The application of a fixed rule for checking luminosity of signals is only reported by a few Railways.

The clearance (or tolerance) allowed when cutting notches in detector slides

or in lock stretcher bars varies considerably.

For the checking of these tolerances, certain Railways supply a standard gauge.

Signal wires and point rods are usually protected when they cross the track. Various methods of protection are resorted to.

Tools placed at the disposal of line-men are enumerated in an inventory list unless, as is the case for certain Railways, the men have to supply their own tools. The kind and variety of these tools usually differ only slightly from one Railway to another.

There is great diversity in the means used for indicating, by signal arms, whether the track is open or closed.

The oblique position in the upper quadrant, as well as in the lower quadrant, is used, the « line clear » indication being given by raising or lowering the arm.

Signal posts are not always provided with fixed ladders and platforms. Signal lamp maintainers are only supplied with safety belts by a few Administrations.

The distance between mechanically-operated signals and their signal boxes varies a great deal. The longest distance is 2 500 m. (8 200 ft.), reported by the French railways.

As a general rule, periodical inspections of mechanical and electrical appliances are made, but no statistics thereof are kept.

Most managements do not keep any statistics of the total burning hours of signal lamps. The use of double-filament lamps is only reported in a few instances.

The most common procedure is to use a voltage lower than the rated voltage. On certain Railways it is the practice to replace automatic block signal lamps after they have burnt less than their rated life.

The total burning hours of lamps also

varies considerably. The maximum figure reported is 4 000 hours.

The use of rigid tubular or channel-shaped rodding is very frequent. Ungalvanised point rodding is regularly repainted, according to requirements. Administrations who use wire transmission do not resort to any special precautions for protecting the outer coat of paint on the wires.

Enamelled iron signal arms are being more and more used; wooden arms are gradually going out of use.

If the position of signal arms is repeated electrically, use is generally made of an insulated closed circuit for this purpose; on a number of Railways this circuit is provided with a safety fuse, the resistance of which is determined very accurately.

A record of track-circuit tests, filled in periodically, is only required by certain Administrations. Some Railways keep such records only in the case of track circuits in automatic block territory.

The interval between tests and measurements differs much.

The minimum allowable train shunt is not uniform.

As a rule the length of track circuit is fixed so as to suit the desired shunt values. Although on many Railways the track circuit relays are sent in for overhaul at different intervals, the general practice is to ascertain, by tests in the field, whether the overhaul is necessary.

There is considerable diversity as regards locking methods and the way electric locks are fitted on interlocking frames.

As regards circuit makers used to repeat signals, it is the general practice for an angle of 10° of movement of the signal from the danger position to open the circuit.

Motor-operated point machines are generally cleaned during slack traffic periods. As a rule the normal traffic is not stopped.

On most Railways the relative point operating circuits and signal locking circuits must be rendered inoperative while the work is being carried out.

It is the general practice to adjust the charging rate so as to avoid overcharging the accumulators. Only a few Administrations prescribe a periodical discharge.

Such Railways who report the use of token instruments usually require the transfer to be recorded, the recording statement being signed and countersigned as many times as deemed necessary.

The token system is but rarely used.

The use of mild steel for signal equipment is reported by a great many Administrations.

Electric welding (or oxy-acetylene welding) is used by a few Administrations with satisfactory results. Only one Railway reports the use of electric welding on iron rodding. The most common type of signal post is of tubular or lattice construction.

The use of reinforced concrete posts is gradually extending.

Paints having a white lead base, as used on bridges, are most commonly used, but tar or graphite paints are also used to some extent.

Recovered lubricating oils are used as much as possible, especially for the lubrication of outside equipment.

Colour-light signals, are normally under-run by day, and by 20 to 45 % during the night. As a protection against phantom indications the usual procedure is to blacken the interior fittings or provide hoods, and a plain lens is used, with which the phenomenon does not occur.

The maintenance of automatic train control equipment or locomotive cab signalling apparatus is as a rule effected by the signalling staff as regards the electrical equipment outside the locomotive and by the locomotive running de-

partment as regards the locomotive equipment.

The systems being new and different and the number of Administrations who have adopted them being small, no more or less general regulations on the inspection tests can be reported so far.

Where centralized traffic control installations are in service, they are generally maintained by the signal maintainer as part of his ordinary duties.

As special apparatus devised for use on signal maintenance work, the following are reported: a handling force meter for determining the force required to handle a mechanical lever, an angle indicator for measuring the angle at which a signal arm is set, and a spring balance meter used to determine the force necessary to throw over points.

III. — Metal supports carrying the contact wires on electric railways.

27 Administrations replied to the questionnaire on this subject.

The Italian State Railways and the Swedish Railways own the greatest mileage of electric railways operated by overhead contact wires, viz. 3 100 and 2 600 km. (1 925 and 1 615 miles) respectively.

The distance between supports carrying the contact wires varies from 60 to 100 m. (197' to 328') on main lines.

As a rule, the electrical engineer of the Chief Mechanical Engineer's Department is responsible for maintenance of the supports. In the case of certain Railways the Permanent-Way Department or a separate Electrical Department is responsible.

The staff maintaining the contact wires also maintains the supports, whilst on certain Railways this staff also attends to substations.

The man power employed per mile of track varies considerably according to the kind of other work which the staff has to do and according to the kind of

traffic: purely electric traction or mixed traction method.

Regular inspection of supports, which is usually carried out by the maintenance staff, takes place at varying intervals.

Various types of metal supports are encountered: tubular, U or L sections, assembled by riveting or welding, rolled sections with wide flanges, and old rails assembled by arc welding.

As a rule, supports are fixed in concrete blocks. It is only in cases where the nature of the soil makes it necessary that these concrete blocks are seated on piles, or that the supports are anchored.

It is of interest to mention the use, in poor soil, of portal supports having concrete foundations of slight depth and wide area, connected under the track by means of rails.

Mention is also made of the following kind of foundation: the support is merely sunk in the ground and rests, on the side furthest removed from the track, against a reinforced concrete sleeper placed in the ground and, on the side towards the track, against a similar sleeper placed just below the surface of the ground. In this manner the force set up by the loading of the contact wire is counterbalanced, independently of the vertical load of the support, by the lateral thrust of the earth.

Protection of steel supports against bad weather is usually obtained by applying 1 or 2 ground coats of red lead and 2 outer coats.

Complete galvanizing of supports is being more and more used.

Metallization by spray-painting is being tried out on certain Railways; in other instances this method has already been abandoned, as it has not given satisfaction.

Repainting, which is done at intervals of 3 to 10 years according to local circumstances, and sometimes even at still longer intervals, is done either de-

partmentally or by contract. As a rule, this work is done by hand only.

Supports of which the parts under voltage are sufficiently far removed are fairly often painted without cutting off the current.

When work has to be done at distances that come below a certain minimum the current is cut off and the parts concerned are earthed.

Summary.

1. It is advisable that the staff responsible for the design and the planning and construction of metal bridges should directly or indirectly intervene in the maintenance of such structures.

2. By the use of pneumatic or electrical derusting apparatus maintenance costs can be reduced.

3. When periodical repainting is undertaken, it is unnecessary to treat large surfaces which are still in a good state of preservation in the same manner as necessary for other surfaces, unless æsthetic considerations require it; in such a case it should be sufficient to apply only the final coat.

4. With a view to avoiding the contingency of removing scaffolding, it is advisable to apply a binding material which makes it possible to apply the following coat of paint soon after the previous coat was put on.

5. The use of spray-painting can, in many cases, enable a saving in the repainting of bridges to be effected.

6. Derusting work and the application of red lead and other paint should be carried out by the Railway's own staff, in preference to contracting out this work.

7. Complete removal of mill scale, followed immediately by the application of a priming coat, reduces the danger of corrosion beneath the paint in the case of new structures, and is conducive to savings in maintenance painting work.

8. In view of the increased train speeds it is advisable, in order to ensure better preservation, namely of old bridges on which the track is not laid on ballast, to use rails assembled by welding.

9. At the extremities of movable bridges, it is advisable to provide rail joints not giving rise to shocks.

10. Savings can be effected in many instances by the use of electric welding for repairing and strengthening bridges.

11. For trough bridges with overhead contact wires, as well as those carrying a third rail under tension, it is necessary to provide a circuit breaker for cutting off the current on the bridge and earthing the contact line during maintenance work.

12. It appears advisable to appoint a special Division or Section for maintaining signal apparatus and all telegraphic and telephonic means of communication.

13. It is, in general, advisable to base the selection and promotion of maintenance staff on their theoretical and practical knowledge, to be ascertained by an examination, and to consider seniority as of minor importance.

14. Periodical checking of the luminosity of signals does not appear to be necessary, as a rule; the reports of the locomotive running department staff are sufficient for pointing out any defects of signals.

15. It is desirable that maintenance staff responsible for checking the detector slide clearance use a special gauge.

16. It is as a rule advisable to slightly underrun signal lamps.

17. Rigid point rodding consisting of tubes of rolled sections have, as compared to double galvanised wires, the drawback of requiring repainting at regular intervals.

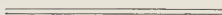
18. The use of enamelled iron signal arms is in the long run more economical.

19. It appears unnecessary to remove track circuit relays for overhaul in the workshops at regular intervals, if well trained staff are available, who can examine them in situ.

20. With a view to eliminating repainting of supports carrying the overhead contact wires or to lengthen the repainting intervals, it appears that complete galvanization of the supports gives the best results.

21. Metallization of supports carrying the contact wires, by spraying compositions in a liquid state, only provides insufficient protection against rusting of steel parts.

22. The use of supports consisting of rolled sections with wide flanges, to which tie-rods or brackets are fixed, lowers the initial cost as well as maintenance costs.



SECTION II. — Locomotives and Rolling stock.

[621. 45]

QUESTION IV.

Evolution of the rail motor car

as regards its construction, and special investigation
into the transmission and brake questions.

Comparative methods of testing railcars.

Detailed investigation into the costs of railcars
and methods of reducing them,

by L. DUMAS,
Special Reporter.

This statement sums up the three reports which dealt with the above question, viz :

Report (North and South America, China and Japan), by E. WANAMAKER ⁽¹⁾;

Report (Germany, Austria, Bulgaria, Denmark, Egypt, Finland, Greece, Hungary, Norway, Poland, Rumania, Sweden, Switzerland, Czechoslovakia, Turkey, Jugoslavia), by Herr STROEBE ⁽²⁾;

Report (Belgium and Colony, Spain, France and Colonies, Great Britain, Dominions and Colonies, Italy, Luxemburg, Netherlands and Colonies, Portugal), by L. DUMAS and J. LÉVY ⁽³⁾.

*
* * *

I. — General.

Most Administrations develop their stock of modern railcars on the one

hand, in order to *improve their services*, and on the other — subsidiarily, they state — to effect savings.

The improvement of the service is the result of the higher overall speeds made possible by the use of railcars : modern railcars are indeed characterised by their high maximum speeds (100 to 120 km. = 62 to 75 miles for railcars on secondary lines, 140 to 160 km. = 87 to 100 miles for fast railcars), their quick acceleration (80 km. = 50 miles an hour in less than 80 seconds), and their powerful braking means [modern American railcars can be stopped from 145 km. (90 miles) an hour within a shorter distance than that needed by a steam train from 96.5 km. (60 miles) an hour].

The improvement is also the result of the possibility there is of setting up at low cost new services which will bring back patrons to the railway, and prepare the way for more such services.

As regards the savings, they are particularly appreciable whenever it is possible to replace a little used steam train by a railcar of sufficient capacity.

The modern railcar dates back to 1932.

⁽¹⁾ See *Bulletin of the Railway Congress*, April 1937, p. 857/1.

⁽²⁾ See *Bulletin of the Railway Congress*, May 1937, p. 1281/39.

⁽³⁾ See *Bulletin of the Railway Congress*, May 1937, p. 1363/121.

During the years 1932 to 1935, the Railways endeavoured to find new satisfactory technical solutions (engines, transmissions, brakes) to meet the essential problems as regards *speed, acceleration, braking and safety*.

The vehicles have been lightened as much as possible, the technical problems to be solved being somewhat simplified as a result.

Speeds of 190 km. (118 miles) an hour and over have been reached in the course of tests carried out at the same time in Germany (SCHNELLTRIEBWAGEN), the United States (ZEPHYRS) and France (BUGATTI).

Quite as sensational accelerations and decelerations were obtained, for instance, with the Michelins which reach 80 km. (50 miles) an hour in 42 seconds, and stop from this speed within a distance of 90 m. (295 ft.).

While perfecting the solutions arrived at, the Railways also tackled other problems which can only be solved experimentally: *comfort and cheap maintenance*.

Finally, and without waiting for the final solution of these questions, the Administrations are now grappling with the third stage of railcar development, viz. the substitution of high-capacity railcars for the crack steam trains, even when the latter are fully patronized.

The future of railcars will depend on the more or less satisfactory solutions that will be found to these various problems, and also, it should be stated, on the *adaptation of the track to the characteristics of the railcar* (superelevation, curves and above all *elimination of rail joints*), and finally on the *renovation of operating methods*.

II. — The engines.

Accumulator-driven railcars are no longer ordered as it is considered that they are too heavy, and their radius of action too small.

Steam railcars are only ordered in small numbers, owing to the difficulties encountered as regards condensing and automatic boiler control.

Petrol railcars still find favour in France (MICHELIN and BUGATTI) in Czechoslovakia (SOUSEDIK) and in Austria.

The general tendency in Europe as well as in the U.S.A. is to use more and more powerful diesel engines, such engines having made considerable progress in the last years.

Modern diesel engines for railcars can be divided into 3 classes :

(a) Engines of 600 to 1 800 H.P., weighing from 6 to 10 kgr. (13 to 17.5 lb.) per H.P., which are characterized by their economical working and maintenance. These engines are : — those that equip most of the American fast motor trains (ELECTRO-MOTIVE—WINTON), the new SULZER engines (800 H.P. at 1 200 r.p.m.) and the new M.A.N. 1 300-H.P. supercharged engines of the German State Railways. These engines are as a rule installed on the underframe of the first vehicle of the multiple unit, which thus becomes a lightened diesel locomotive.

(b) Engines of 300 to 600 H.P. weighing about 5 kgr. (11 lb.) per H.P. These engines ⁽¹⁾, which are less advantageous as regards maintenance than the preceding engines, are nonetheless preferred by many Administrations because their location on the bogie (or in the middle coach in the case of the Dutch rakes) allows of an all-round lighter construction being obtained, together with an increased passenger carrying capacity.

(c) Engines of 200 to 300 H.P., the sturdiness of which approaches that of road motor car petrol engines.

(1) Maybach 410-H.P. and 600-H.P. supercharged engines (Germany); Frichs 400-H.P. (Denmark); Fiat 450-H.P. (Italy); Renault 500-H.P. (France); Peugeot, C.L.M. (France); M.A.N. 560-H.P., supercharged (Germany) etc.

New engines of this power, of the horizontal type, are on trial; by their use the whole of the railcar floor space remains available for passenger and luggage purposes (Czechoslovak C.K.D. and SKODA engines; German D.W.K., DEUTZ, DAIMLER-BENZ and M.A.N. engines — all with precombustion chamber to allow of national fuels being used; French PEUGEOT and C.L.M. engines).

Supercharging, the use of which is extending, allows of a higher horsepower being obtained for equal engine weight; at the same time there is less wear and tear of the motion, and savings are effected on the engine cooling plant.

The present-day practice is to equip railcars with engines having excess power (10 to 15 H.P. per ton), in order to obtain better acceleration and avoid excessive wear of the engines.

III. — Transmissions.

Up to 300 P.H., the mechanical transmission is at present the lightest and cheapest, and it has the highest efficiency under normal running conditions.

Many designs have proved their value. By preselecting the speeds, the transition from one speed to another is instantaneous. Some designs are being perfected (ARDELT) with a view to maintaining the full engine torque while changing speeds; the hydraulic clutch and the free wheel effectively protect the engine from any wrong moves on the part of the driver.

A RENAULT 500-H.P. mechanical transmission is on trial in France, and FIAT and COTAL 450-H.P. mechanical transmissions in Italy.

Railcars equipped with mechanical transmissions can now be coupled and run together (e.g. DE DIETRICH railcars).

Above 300 H.P. the *electric transmission* provides the technical solution of the problem; it has been adopted by a great number of Administrations, notably for services over particularly steep

mountain lines (DECAUVILLE, P.L.M. Railways), or for multiple-unit working (Netherlands).

Recent improvements provide isopower, automatically balance the temperature variations of the equipment, do not stress the engine, and even protect it in case of failure.

Next to these two classic transmissions, the *hydraulic transmission* has made definite progress in Germany and Austria, thanks to the efforts of Messrs. VOITH.

145 hydraulic transmissions were ordered in Germany in recent years. At the conclusion of the satisfactory tests undergone by the two ultra-fast triplets (Leipzig), the German State Railways ordered 6 diesel-hydraulic triple railcars (2×600 H.P.) for the Ruhr District, 30 diesel-hydraulic single railcars with M. A. N. engines developing 360 H.P. at 900 r.p.m., and 20 diesel-hydraulic single railcars with 225-H.P. engines.

In Austria, such transmission has been adopted for 21 new light petrol railcars.

Finally a remarkable *electro-mechanical* transmission (SOUSEDIK), with which the electrical part is used for starting and the mechanical part for full-speed working, has just been tried in Czechoslovakia (Slovak Arrow). With this system, which has been tried with a 330-H.P. diesel engine, the weight of the electrical equipment is only one third that of an ordinary electric transmission and its efficiency coefficient is 10 % higher than that of the purely electric transmission.

IV. — Bogies. — Running gear.

By means of appropriate arrangements, the Administrations are endeavouring to reduce to a minimum hunting movements of bogies, and to damp out as much as possible the shocks caused by the wheels when running over rail joints, or over points and crossings.

The use of tyres coned 1 in 40 (Germany) or cylindrical tyres (carrying

wheels of American fast motor trains, carrying and driving wheels of French triplets), the provision of triple and even quadruple suspension (Germany), the interposition of rubber blocks between the body and the bogie or between the diesel engine and its support, are all methods which have not given rise to any difficulties and can be recommended.

Some Administrations also use devices for damping out the hunting movements and vertical oscillations of bogies — articulated or independent —, six-wheeled or eight-wheeled bogies, loose wheels on fixed axles, axle boxes without axle guards. All these methods have given them satisfaction.

Several Administrations have ordered bogies, built on mass-production lines, which they use at speeds up to 120 km. (75 miles) an hour, a particular feature of which is that the whole weight of the body is borne by bolsters; these bogies are remarkable for their good riding qualities.

Unlike what might be thought, both axles of a bogie may be driven from a single mechanical transmission which permanently connects the two axles (Swiss WINTERTHUR transmission).

Pneumatic-tyred vehicles are still quite satisfactory; it has been noticed that the pneumatic tyre effectively protects the very light body, the maintenance costs of which are therefore practically negligible.

V. — Brakes.

The service brake is as a rule a block brake, the action of which can be regulated when applying and releasing it, and which is distant-controlled by compressed air.

The tendency, in the case of ultra-high speed railcars, or of multiple-unit railcars or vehicles running in pairs, is to reduce the time lag constant by instantaneously controlling the application and

the release of all the brake blocks by means of electrovalves, the possibility of regulating the braking effort being retained thanks to the use of a combination of pneumatic and electric control devices. These self-regulating electro-pneumatic control devices are used in the United States, in Czechoslovakia (Slovak Arrow), and will be used on the new German fast railcars.

In order to reduce the braking (stopping) distances, some Administrations use on their fastest railcars either « Decelakrons » with which the air pressure is proportional to the deceleration (U.S.A.), or systems with which the air pressure is proportional to the speeds (France and Germany). Devices intended to prevent the wheels from picking up, or to release them once they have picked up, are also being tested in France.

The brake drum with interior brake cheeks is loosing ground owing to the rapid wear of the linings, save in the case of very light railcars, of the road motorbus type.

The simultaneous use of plastic linings of the Ferodo type and cast iron blocks has been incorporated in the ingenious N. R. system which, by combining the advantages of the block brake and the drum brake, has made it possible to obtain, with all speeds and even on wet rails, the maximum retardation effort compatible with adhesion.

The drum brake with exterior brake cheeks is likewise losing ground, because it is slow in dissipating the heat; the disk brake tends to take its place.

The electro-magnetic brake, the drawbacks of which (they were reported at the Enlarged Meeting of the Permanent Commission of the Association, 1935) have been much reduced at present, thanks to the use of lamellated pole pieces, is used on many European railcars, but always as an emergency or standby brake.

We still wish to mention the eddy-current brake, of the SOMUA system (P.L.M.

Rys.), which proves very useful when running down long gradients.

VI. — Comfort.

It has been stated at the Enlarged Meeting of the Permanent Commission in 1935 that comfort depends on four factors :

(a) Riding. — Absence of resonance between the different spring gears. Absence of hunting movements;

(b) Upholstering of seats damping out the small vibrations transmitted by the body;

(c) Acoustical insulation;

(d) Air conditioning.

Additional comfort is often provided at the present time by the use of separate compartments, which are much appreciated in the case of long journeys, and by the provision of bars, special restaurant compartments, lounges with library, observation saloons at the rear, wireless, and even telephones.

Contrarily to what might be thought, it is possible to make coaches of very light design (aluminium trains of the Union Pacific; Charentaise railcars; American stainless steel rakes) as comfortable as standard railway rolling stock.

Unrivalled results have been obtained as regards sound insulation by the use of pneumatic tyres (Michelines). With the steel-tired vehicles it is indispensable to provide many double partitions with air cushion in between, to make sure windows, inspection traps and doors are perfectly tight, and to prevent plates from vibrating by applying a coat of pulverised wool, for example.

As regard air conditioning, the Railways are no longer satisfied with only providing the best temperature in summer and in winter, but have turned their attention to the frequent renewal of the air and the control of its moisture content.

In the U.S.A., where all long-distance

trains are air-conditioned, and in France — in the case of the fast railcars which have fixed lights — elaborate cooling plant has been installed, in which either ice or more often freon are used. Such plant is unfortunately very heavy and very costly, and consumes much power (between 10 and 15 kw. per vehicle).

VII. — Maintenance and cost price.

Railcar maintenance includes different overhauls at varying intervals: fuel pump overhauls after 20 000 km. (12 400 miles), engine repairs after 100 000 km. (62 000 miles), body overhaul after 250 000 km. (155 000 miles), for example. On the occasion of such repairs, such details as show undue wear are replaced, so that the whole part may await without damage the following periodical overhaul.

Thus railcar maintenance is preventive in its essence. It requires handling plant, test benches and devices for detecting incipient cracks, important lots of spare parts, but few machine tools. It in no way resembles steam locomotive maintenance work.

The repair shops at Florence (Italy), Louvain and Malines (Belgium), Haarlem (Holland) may be mentioned as typical examples.

Maintenance costs together with amortization charges make up the biggest part of the cost price (50 to 70 %).

For all that, there is some uncertainty as regards the amortization charges which until recently have been calculated on a 300 000-km. (186 000 miles) basis, whereas in Belgium fast railcars brilliantly passed the 500 000-km. (310 000 miles) mark.

On the other hand, modern railcars being only built a few units at a time, their first cost is very high, as it includes expenditure on research, design, tests, etc., which will no longer affect future constructions. (A modern Amer-

ican motor train made up of 3 or 4 coaches costs 250 000 dollars, a 17-car train 1 500 000 dollars.)

It would have been quite interesting to compare the cost-price of the railcar-mile on the various Railways. This has not been possible as the Administrations had not agreed beforehand on a simple method showing at the same time the expenses and the time spent in performing the various operations. All that can be said is that, taking into account the amortization charges, the cost price of railcars varies between 40 and 60 % of that of the corresponding steam train, according to the amount of comfort offered by the railcar, its maximum working speed, and its capacity.

Two methods are resorted too in order to reduce the cost price of railcars. In certain countries (U.S.A., Denmark, Germany in the case of recent designs), low-speed engines are used, amortization charges are heavy, but maintenance costs are low. In the other countries high-speed engines, which permit of lightening the design to a maximum, are preferred; their maintenance costs, however, are higher.

The first method obviously provides the higher coefficient of use. The latter is effectively 95 % for all types of American fast motor trains.

In view of the practical importance of this coefficient, which gives an exact measure of the sturdiness of the rolling stock and a valuable indication as regards the service that may be expected from it, it would be desirable that the Administrations come to an agreement so that this coefficient may be calculated in the same way.

VIII. — Increasing the capacity of railcars.

There is a tendency on most Railways to increase the capacity of their railcars, in order either to avoid duplicating a trip at rush time, or to replace by one

or two railcar trips some insufficiently used steam trains.

The question is to remain well below the cost price per mile of the steam trains.

The capacity of railcars can be increased in different ways :

(1) Some Railways locate the engines and the whole mechanical plant under the floor, thus obtaining an unobstructed view of the landscape, which is much appreciated by the public. Such is the case in England (Great Western), Germany (D.W.K. two-engined observation railcars), France (96-seater Micheline and new Standard observation railcar), etc.

(2) Other Administrations take care that their railcars can be run as twins, or simply be coupled together, thus obviating the need for two distinct railcar trips and thereby liberating the road. In certain cases, the train staff has access from one railcar to another when such vehicles are coupled together (Hungary, Buenos Ayres & Pacific Railway),

(3) Other Railways again equip their railcars with engines sufficiently powerful to haul a trailer, of special design or not.

(4) Finally, and this is the method most generally used, many Administrations build multiple-units, made up of 3, 4 or more coaches. Such rakes can often be coupled up to make up rakes of 6 to 12 vehicles (Dutch rakes, for example).

Among the triple railcars, the German, American, Belgian, Danish, French, Dutch and Italian railcars should be mentioned; moreover the London Midland & Scottish Railway and the Great Northern Railway (Ireland) are now completing such rakes.

As regards quadruple units, the following should be mentioned : — Danish rakes (in service); the American motor trains (Mark Twain, Zephyr, Rebels, also in service), and the quadruplets under construction in France and Germany.

Among the multiple-units made up of more than 4 cars, the following should be mentioned : — the two twin Zephyrs of seven coaches each and two 12-car Denver Zephyrs of the Chicago, Burlington & Quincy R.R.

The Illinois Central has in service the « Green Diamond » made up of 5 vehicles.

The Union Pacific has in service 5 multiple-units made up of from 7 to 12 coaches, and has ordered a motor train made up of 17 vehicles, equipped with three 1800-H.P. engines per train.

The Chicago, Rock Island and Pacific has under construction six 1200-H.P. diesel-electric trains, 2 of which are 5-car units.

Owing to the necessity there is of increasing the capacity of multiple-units, most Administrations have been led to abandon the articulated (common) bogies, of the Jakobs or other type, although they were satisfactory from the technical point of view, and to resort almost exclusively to bogies of the standard railway types, two bogies being used under each vehicle.

IX. — Tests.

The FERNAND-ROUSSELET test method, recommended by the Enlarged Meeting of the Permanent Commission, in 1935, is being used by different Administrations, with satisfactory results.

For determining the same coefficients (with the exception of the aptitude for acceleration) the Deutsche Reichsbahn has perfected a somewhat different experimental process in which, for instance, the air resistance is not determined by a limit speed on lines of known slope, but by the stopping curve recorded on level track. On the other hand, instead of recording gradient climbing capability curves by limit speeds on various gradients, the Reichsbahn ascertains, on level track, the excess power of the railcar which is made to haul a dynamome-

ter car, the brakes of which are applied to a sufficient extent.

The Hungarian Railways have devised an original method for measuring the efficiency of transmissions, 2 motor bogies carrying electric motors instead of the Ganz engines, which motors are coupled up mechanically, being used.

It would be desirable for Railway Administrations to agree on a test method of such conception that it would be possible to correctly compare the results obtained in the various countries.

On the other hand, it should be noted that the nominal power of engines is not defined in a uniform way in the different countries. It is generally admitted that the nominal power is that which an engine can sustain indefinitely without fatigue or abnormal wear, and this power is ascertained by means of a long-duration test (72 hours, for instance). It would be desirable that Railway Administrations agree on a common definition of the nominal power of their engines.

Summary.

I. Satisfactory technical solutions have been found in the course of the last two or three years to the speed, acceleration, braking and safety problems.

The future of the railcar now depends on the solutions that will be adopted as regards comfort, economical maintenance and capacity. This future also depends on future improvements of the track (curves, superelevation, elimination of rail joints or reduction of their number), and on the adaptation of the operating methods to the rail motor car.

II. Railcar diesel engines can be divided into three classes :

(a) 600 to 1800-H.P. engines, relatively heavy, but very economical as regards working and maintenance; such engines are used extensively in the United States of America;

(b) 300 to 600-H.P. engines weighing

about 5 kgr. (11 lb.) per H.P., as adopted by most European Railways;

(c) 200 to 300-H.P. engines, amongst which the Czechoslovak, German and French horizontal engines deserve special mention.

By the use of supercharging, which tends to extend, the weight/power ratio of engines can be reduced; improved behaviour of the motion and better dissipation of the lost heat units are also obtained.

III. Mechanical transmissions are quite satisfactory, as regards weight, cost and efficiency, up to 300 H.P. Mechanical transmissions for 450 and 500 H.P. are being tested in Italy and in France.

Electrical transmissions are now fully perfected for all powers, and are preferred for services on mountain lines and for multiple-unit working.

Hydraulic transmissions have made definite progress in the course of the last two years, in respect of all powers and engine speeds, in Austria and Germany.

IV. In order to reduce hunting movements to a minimum and to obtain improved comfort, Railways are now currently using wheel tyres coned 1 in 40, cylindrical tyres, multiple suspension gear and rubber shock absorbers: such devices have not given rise to any difficulty and their use can be recommended.

Some Administrations also use devices to damp out hunting movements and vertical vibrations, bogies (articulated or not) with 6 or 8 wheels, loose wheels revolving about fixed axles, axle boxes without axle guards, etc. All these solutions have given them satisfaction.

V. Block brakes are most generally employed at present; they are electrically controlled in certain countries (U.S.A., Czechoslovakia) and improved by the use of *Decelakrons* or self-regulation in proportion to the running speed. Amongst new brakes, the disk brake, the

eddy-current brake and the N.R. brake with double shoes should be mentioned.

VI. Sound-proofing and air-conditioning are particularly resorted to at present in order to increase comfort.

Steel-tired vehicles — although they cannot claim the same comfort as pneumatic-tired vehicles — can be improved by means of double partitions with air cushion; all openings should be carefully stopped up, and plates be lined with pulverised felting in order to avoid vibrations.

Air conditioning, and air cooling in summer (by means of ice or freon), are particularly appreciated in vehicles with fixed window lights.

VII. Maintenance costs and amortization charges are the biggest items in the cost price.

The first cost of American railcars is high, but their maintenance costs are reduced to a minimum; in Europe, the desire for lightness has generally led to cheaper construction, which entails higher maintenance costs.

It would be desirable that the Railways agree to calculate in a uniform way the coefficient of use of their railcars, and their cost price.

VIII. Most Administrations tend to increase the capacity of their railcars, so as to be able to substitute them for steam trains on an increasing scale. The question is to remain very much below the cost per mile of a train.

As regards general design, various solutions are being resorted to: observation railcars, twin railcars or single railcars coupled together, railcars hauling trailers, multiple-units of 3 to 17 vehicles.

IX. It would be desirable for the Railway Administrations to adopt a common test method for ascertaining the characteristic constants of their railcars.

On the other hand, the nominal power of engines should be given the same definition in all countries.

QUESTION V.

Recent improvements in steam locomotives

of the usual type and tests of new designs (high-pressure reciprocating locomotives and turbine locomotives) as regards construction, quality of materials used, efficiency, working conditions, maintenance and financial results.

Testing locomotives

at locomotive experimental stations, and in service with dynamometer cars and brake locomotives,

by Sir H. Nigel GRESLEY, C.B.E., D. Sc.,
Special Reporter.

Foreword.

Reports on Question V have been received from the following Reporters :

Messrs. PARMANTIER and DUGAS ⁽¹⁾ (Germany, Austria, Belgium and Colony, Denmark, Finland, France and Colonies, Hungary, Luxemburg, Norway, Netherlands and Colonies, Poland, Sweden and Switzerland);

Signor MASCINI ⁽²⁾ (Italy, Spain, Portugal and Colonies, Czechoslovakia, Yugoslavia, Bulgaria, Rumania, Greece, Turkey and Egypt);

Sir H. Nigel GRESLEY ⁽³⁾ (Great Britain, Dominions and Colonies, America, China and Japan).

Replies to the questionnaire sent out have been received from no less than fifty Administrations.

The purpose of this special report is to summarise the main features of the reports just referred to, and to set forth

the conclusions to be drawn therefrom, which should form the basis for discussion at the Congress.

The question has been divided into three parts :

- I. Improvements in steam locomotives of the usual types since 1930.
- II. Tests of new types of steam locomotives constructed since 1930.
- III. Testing of locomotives at testing stations and on the line.

* * *

PART I.

Improvements in steam locomotives of the usual types since 1930.

Increased boiler pressure.

Messrs. PARMANTIER and DUGAS consider that high pressures give greater efficiency but that 284 lb./sq. inch (20 kgr./cm²) is the maximum pressure that can be used conveniently at the present time owing to : (I) the difficulty of building the boiler within reasonable weight limits, and (II) the difficulties and disadvantages of using steam at very

(1) See *Bulletin of the Railway Congress*, December 1936, p. 1291/1.

(2) See *Bulletin of the Railway Congress*, April 1937, p. 895/157.

(3) See *Bulletin of the Railway Congress*, April 1937, p. 1041/303.

high temperatures. Their report contains some data as to the materials used in high-pressure boilers.

Signor MASCINI dealt with Parts I and II of the question together and reviewed the high-pressure steam engine from its theoretical and commercial aspects. He came to the conclusion that any fuel economy obtained was more than counterbalanced by higher first costs and maintenance costs.

His investigations led him to suggest that the steam locomotive of the usual type of the future will use steam at medium pressure, such as 356 to 426 lb./sq. inch (25 to 30 kgr./cm²). He pointed out that high pressure steam involves :

- (a) High initial superheat temperature.
- (b) Compounding.
- (c) Intermediate superheating.

In the countries covered by the Author's report the comparatively small increase in pressures recorded have not affected the cost of maintenance.

Improved water circulation.

Improvements in water circulation and increased evaporation have been realised as a result of the chemical treatment of feed waters, but as offset to the saving which must accrue, account must be taken of the heat loss occasioned by blowing down a proportion of the boiler water to the track. Some form of blow-down is generally recommended if priming is to be prevented, and in order to enable periods between washing out or water change to be increased.

The fitting of arch tubes and thermic siphons appears to be justified in certain circumstances, as evidenced by the Nord of France and P.O.-Midi Railways, which consider that the provision of siphons compensates for the reduction in heating surface due to the increase in the number of superheater flue tubes and consequent reduction in the number of

small tubes. An additional advantage is a reduction in the time taken to raise steam.

Improved combustion.

In countries covered by the Author's report, there is a general tendency to increase the air space through the grate, the amount of increase varying from 20 % to 30 % of previous ratios, but this has been standard practice in France for some time. Extensions of the firebox into the boiler barrel to provide extra space for combustion have been adopted on a number of engines of the English, French and Japanese Railways.

Superheating.

Steam, superheated to a temperature of 752° F. (400° C.) appears to be the optimum admissible at the present time. Whilst it is possible to obtain higher superheated temperatures, it is not practicable to do so on account of the difficulties of lubrication and the effect of such temperatures on the metals with which the steam comes in contact. From thermodynamic considerations, higher pressures necessitate higher superheat temperatures in order that the saturation point of the steam is not reached before it has performed its work. With the higher pressures, in order to keep the steam superheated during expansion, intermediate superheating is sometimes adopted on compound locomotives.

Feed water pre-heating.

Whilst there is data to show that the feed water heater is capable of effecting fuel and water economies over the exhaust and live steam injector, in many cases the savings thus realised are neutralised by the increased cost of maintenance, but in the opinion of Messrs. PARMANTIER and DUGAS, feed water heaters are justified by their ability to increase the output of the locomotive and to improve the life of the firebox. It is the practice with all mo-

dern locomotives to equip them with either feed water heaters or exhaust steam injectors.

Air pre-heating.

Air pre-heating has made no progress since 1930.

Improved blast pipe design.

Double blast pipes and chimneys have reduced back pressure, and in consequence the power and efficiency of locomotives can be increased by their adoption. « Jumper » or other variable blast pipes have attained some measure of success in that coal consumption has been reduced, but opinions are divided on the final value of such devices. With low pressure exhaust, the difficulty of raising the smoke clear of the cab windows can be overcome by inclining the front of the smokebox.

Valves and valve gears.

Since 1930 there has been an increase in the number of special valve gears fitted to locomotives. Examples are the long-stroke Walschaerts gear as described by several Administrations, and double-ported and cam-operated piston valves and poppet valves, which have now passed the experimental stage and are fitted to the locomotives of many Administrations.

Pistons.

There is an interesting development in piston ring design from America, namely, that of special sectional piston rings of « L » shaped construction in five or more segments, preventing any contact between the piston head and cylinder walls when the rings wear down.

Improvements in the steam circuit.

There is general agreement in recognising the value of increasing the diameter of pipes and the size of passages forming the steam circuit, and the tendency is to carry out these improvements

on many of the older engines, with resultant less drop in steam pressure between the boiler and the steam chest.

Streamlining.

Streamlining is a comparatively new feature in locomotive design and is consequent upon the adoption during the last two or three years of extra-high-speed trains. Many forms of streamlining have been tried, and wind tunnel tests with small-scale models have shewn that a considerable saving in horse-power required to overcome head-on air resistance can be realised at high speeds. Line tests on the Continent with actual locomotives streamlined and unstreamlined confirm this statement, and also exhibit a substantial coal and water saving in favour of streamlining. It is, however, necessary to accept the figures given with some reserve, as conditions under which line tests are carried out cannot be ensured to provide a strictly uniform basis for comparative trials. The streamlining of some of the older engines is claimed to have saved them from being broken up as, prior to streamlining, they were unable to reach and maintain the higher speeds required.

Special steels and light alloys.

Whereas in other parts of the world the use of special steels for motion parts, springs, etc., is increasing, the report on the countries covered by Messrs. PAR-MANTIER and DUGAS indicates that their use is not being very much extended, but the replies received by the Author indicate that the use of alloy steels for connecting and coupling rods is being considerably increased. Light alloys have been tried out for a variety of fittings with the object of reducing weight, but no forecast can yet be given as to their continued use.

Mechanical firing.

It cannot be said that mechanical fir-

ing has been very generally investigated. Only a few of the railways have made tests, and it is too early yet to express any opinion as to the future.

Oil firing.

The Central Argentine Railway referred to in the Author's paper reports that all their locomotives are now coal-fired. Of the countries covered by Messrs. Parmantier and Dugas, the only developments that can be reported to the Congress on the subject of oil firing are that trials are in hand on the French State and P.O.-Midi Railways with oil-fired boilers, and that on the Reichsbahn and Austrian Federal Railways, auxiliary oil burners have been fitted to a few coal-burning engines.

Pulverised fuel.

The use of pulverised coal on locomotives has made no headway in the general sense. The Reichsbahn and Hungarian State Railways have carried out some tests with pulverised lignite, and the former Administration expresses the opinion that a saving in operating costs can be made. In any event, justification would only be possible if the firing with lignite were carried out on a large scale, in view of the capital cost of plant for the storage and mechanical preparation of the fuel.

*
* *

PART II.

Tests of new types of steam locomotives constructed since 1930.

Generally speaking, of the new engines referred to in Part II, those which are in service have been running such a short time that any comparison with comparable types previously built as regards performance, maintenance and reliability, is not yet possible.

Several interesting new types of steam

locomotive have been reported to the Congress by Messrs. Parmantier and Dugas, but the only one in service is the Ljungström locomotive of the Grängesberg-Oxelösund Railway, which is a 2-8-0 non-condensing turbine locomotive.

Since the new types of locomotive are not yet in service, it is felt that beyond mentioning the special features in their design, not much else can be reported to the Congress during this session.

The Reichsbahn is redesigning its turbine locomotives as a result of tests carried out on the stationary plant and on the line.

In France the following new types are under construction or under consideration. The Nord Railway has placed an order for one 4-6-2 type locomotive on the Winterthur system. The boiler pressure is 853 lb./sq. in. (60 kgr./cm²). Each of the three pairs of coupled wheels is driven by two groups of three-cylinder high-speed horizontal engines.

The P.L.M. have ordered from Messrs. Bugatti a complete high-speed streamlined train consisting of a tender engine and three coaches; the engine will have a water tube boiler and will be mounted on two eight-wheeled bogies each having four driving axles. An eight-cylinder automobile type 250-H.P. engine drives each axle.

The French State Railways have a similar unit on order from the same makers, but the locomotive is a tank engine of only half the power, as four of the axles are driving axles, the remaining four being carrying axles.

The French State Railways have also under construction a 4-4-0 type tank engine on a new system designed by the Dabeg Company. The boiler is orthodox and supplies steam to a twelve-cylinder «V» type engine mounted on the horizontal centre line above the bogie.

The application of a Velox boiler to a 4-6-0 type locomotive is being considered by the P.L.M.

The O.C.E.M. have designed for the French Railways a streamlined 4-6-4 type triple-expansion locomotive, the boiler of which is of orthodox design, carrying a pressure of 356 lb./sq. in. (25 kgr./cm²) and fitted with an intermediate superheater. High-pressure and medium-pressure high-speed engines drive the coupled axles through jack shafts, gears and articulated connecting rods. The low-pressure cylinders are inside and drive the first pair of coupled wheels in the usual manner.

The only example of a turbine locomotive on the English Railways is the L.M.S. 2 000-H.P. non-condensing unit, and although no consumption figures are yet available, the results so far obtained with the engine have given considerable satisfaction.

Signor MASCINI has reported that a Franco type locomotive built for the Italian State Railways is now undergoing dynamometer car trials. The principle of the Franco system consists in feeding the boiler with water preheated by means of the gases leaving the smoke tubes. This is the only unusual type of locomotive dealt with in his report, with the exception of the Beluzzo turbine built in 1933, and which did not prove successful. Signor MASCINI puts forward the view that, for the present at least, the orthodox type of steam locomotive is supreme, meeting as it does the increased demands made upon it for haulage, without seriously affecting the maintenance. It is his opinion that for some years to come steam pressures on locomotives of the normal types will not tend to increase much above 426 lb./sq. in. (30 kgr./cm²). He draws attention nevertheless to the tendency towards extra high pressure boilers with high rates of evaporation and containing only a small quantity of water, supplying steam to a number of small cylinder engines running at a high number of revolutions per minute.

* * *

PART III.

Testing of locomotives at testing stations and on the line.

This part of the report deals chiefly with methods of testing locomotives, and therefore the descriptions of the testing stations, dynamometer cars and brake locomotives are only dealt with briefly.

Locomotive testing stations.

Altogether there are five locomotive testing stations : at Grunewald (Reichsbahn), at Vitry (O.C.E.M.), dealt with by Messrs. PARMANTIER and DUGAS, and at Swindon (G.W.R.), Altoona (Pennsylvania), and Oi (Japanese), which are dealt with by the Author. Four of the five plants employ hydraulic brakes, and one, the G.W.R. plant, a water-cooled hand-friction brake. The dynamometers of the lever type at two of the stations are not sufficiently accurate, and the reciprocating parts of the locomotive under test have to be completely balanced in order to obtain accurate results. The French and German plants employ hydraulic dynamometers with satisfactory results.

With some of the older plants, it is intended to increase the capacity of the dynamometer, the number of braked rollers and the absorbing power of the brakes, to meet present-day testing requirements.

Dynamometer cars.

Practically all the most recent dynamometer cars constructed have been equipped with hydraulic dynamometers on which a number of degrees of sensitivity are provided for pulling and buffing forces of various intensity. The cars themselves are equipped with many special devices for recording measurements of pressures and temperatures at various points in the steam circuit, apparatus for measuring oscillation, water consumption, etc., and provision has

been made in the layout to enable the personnel to carry out tests of long duration.

Brake locomotives.

In the countries covered by the Author's report, testing by means of brake locomotives is only in the course of development by some of the Administrations, but in the reports of Messrs. PARMANTIER and DUGAS and Signor MASCINI, considerable progress in this method of testing has been made.

Two systems are adopted in the working of brake locomotives, namely, the counter-pressure system and the Rigenbach, or compressed air, system. The counter-pressure system has five adherents and the Rigenbach eight.

In every case engines of the 4-6-0 wheel arrangements have been found to be the best suited to act as brake locomotives, although for some high-speed testing, four-coupled engines have been used, and for low-speed testing, locomotives with four and even five pairs of coupled wheels have been employed.

Test methods.

There are four main and quite distinct classes of tests which can be carried out most efficiently at a testing station :

1. Comparative tests, either between two locomotives, or on the same locomotive before and after altering it.

2. Tests of a locomotive of a new type which involve checking certain working conditions as laid down in the specifications.

3. Tests of a more scientific nature, for which the testing station seems to be particularly suitable. This class of test comprises tests on the form and mixture of the gaseous currents in the exhaust of locomotives, the determination of certain coefficients of heat transfer, enquiries into the humidity in superheated steam and its influence on the efficiency. Investigations into the balancing of locomotives.

4. Stroborama tests for following the behaviour and flexing of parts in motion.

The main merit of a testing station is that the maximum power, both engine and boiler, of the locomotive, can be ascertained accurately at different speeds and cut-offs, and that the tests can be repeated under strictly comparable conditions.

As pointed out by Messrs. PARMANTIER and DUGAS, and supported by the Author, testing by means of the stationary plant has reached a high degree of perfection in the scientific study of the steam locomotive. The absence of varying atmospheric and track conditions normally met with in line testing ensures a uniform basis for comparative trials, and since stationary plant testing permits these trials being made under a predetermined set of conditions over a fixed period of time, it is possible to obtain comparative results with a much higher degree of accuracy than is the case with those obtained under service conditions.

Unfortunately, up to the present, no railway has carried out complete comparative trials of a locomotive at the testing station and afterwards on the line with dynamometer car and brake locomotive as, had this been done, the extent of the variation in the results obtained by the two methods of testing could be determined.

One of the criticisms made of the testing station is that the data obtained from the tests is purely scientific and of little practical value as a basis on which, for example, to draw up a time or load schedule for a train, but it must be appreciated that the stationary plant test is not intended to replace the line test. On the contrary, stationary plant testing should be implemented by tests on the line to determine the capacity, efficiency and behaviour of the locomotive under running conditions.

Signor MASCINI reports that neither

the Italian nor any of the other railways dealt with in his report possess a testing station. His report deals with testing by means of brake locomotives in conjunction with dynamometer cars, for which he expresses a preference. He considers that it is desirable that all railways should agree a complete experimental programme for comparison of results, and this would seem to be a most desirable step to take.

Summary.

1. There has not been any marked increase in boiler pressures since 1930. A pressure of about 284 lb./sq. inch (20 kgr./cm²) has been regarded as the limit for boilers of conventional design. A total steam temperature of about 752° F. (400° C.) appears to be the maximum which is desirable owing to difficulties with lubrication, and the effect due to creep of the metals in contact with the steam if this temperature is much exceeded.

2. The enlarging of the steam pipes and passages has reduced the pressure drop between the boiler and steam chest, thereby improving the steam circuit.

3. The scientific streamlining of locomotives appreciably reduces air resistance at high speeds, and therefore increases the horse-power available for traction.

Streamlined locomotives of the reci-

procating type specially designed for extra-high-speed working have been introduced by several Administrations since 1930.

4. The use of non-condensing turbine locomotives is being developed.

5. Testing stations are regarded as essential for the scientific study, and the precise and comparative investigation of the design, performance and efficiency of locomotives and their components.

6. Trials with dynamometer cars in conjunction with brake locomotives form the best method of determining the maximum drawbar horse-power and fuel consumption of locomotives under service conditions.

7. It is desirable that all Railways should agree a standard programme for the testing of locomotives, both at a testing station and under service conditions with dynamometer car and brake locomotive, so that accurate comparative results can be obtained.

ACKNOWLEDGMENTS.

The Author desires to take this opportunity of complimenting Messrs. PAR-MANTIER and DUGAS, and Signor MASCINI, on their most interesting and valuable reports, which it has been his privilege to summarise and present to this 13th Session of the International Railway Congress.

QUESTION VI.

Methods and devices used, in connection with electric traction, to save current between the supply side of the power station and the driving wheels (feeders, substations, tractors), and in particular the use of mercury rectifiers,

by C. E. FAIRBURN,

Special Reporter.

Question VI was made the subject of three reports : —

(¹) Great Britain, Dominions and Colonies, India, North and South America, China and Japan, by Mr. C. E. FAIRBURN.

(²) Austria, Germany, Denmark, Norway, Sweden, Finland, Poland, Hungary, Czechoslovakia, Yugoslavia, Bulgaria, Rumania, Greece, Turkey, by Mr. E. R. KAAH.

(³) Switzerland, France and Colonies, Spain, Portugal and Colonies, Italy, Belgium and Colony, Luxemburg, Netherlands and Colonies, Egypt, by Messrs. EGGENBERGER and ECKERT.

Introduction.

The Reporters sent out a common questionnaire to the Railway Administrations in the territories concerned and, on the basis of the information received, each drew up a report.

These reports do not reveal any fundamental differences of outlook and it is

only in regard to certain detailed points that variations exist.

Questions concerning generating stations were dealt with at the 12th Session, Cairo 1933, and have, therefore, been excluded from these reports.

General.

The general form of the reports was determined by the points raised in the questionnaire. In drawing up this questionnaire the Reporters were aware that questions concerning the plant used on electrified lines cannot be settled on grounds of technical merit alone, but must be decided by the total cost to the Railway of the service performed. That is to say, a method of saving energy is of real utility only when the value of the energy saved is greater than any additional capital or operating charges introduced by its use. Unfortunately, owing to the diversity of systems under review and the differences in operating conditions on the Railways asked to supply information, it was not thought possible to make comparisons of costs and the Reports were restricted to technical aspects of the subject.

The search for the most satisfactory solution of the technical problems presented by railway electrification has led

(¹) See *Bulletin of the Railway Congress*, January 1937, p. 73.

(²) See *Bulletin of the Railway Congress*, March 1937, p. 705.

(³) See *Bulletin of the Railway Congress*, March 1937, p. 641.

to the introduction of many different systems and since these have originated at different times and to meet widely different operating conditions, a direct comparison of their individual advantages cannot readily be made, and it is not possible to claim that any one system is the best for all geographical situations and types of service.

The most important systems now in use can be classified as :

- (1) Direct current.
- (2) Single-phase low-frequency alternating current.

The direct-current systems may be divided into low-voltage and high-voltage systems; in the former case a conductor rail contact system is usually employed and in the latter an overhead conductor is almost universal. There is also in operation a considerable mileage of three-phase alternating-current line, but it seems improbable that this will be greatly extended and there are also some lines using single-phase alternating current at industrial frequency.

An analysis of the losses experienced in the various component parts of these traction systems makes it clear that very large economies cannot be realised by improvements in the electrical equipment, and can be expected only from the direct method of reducing the power required by trains, by using vehicles of better and lighter construction and, in certain cases, by the use of regenerative braking to recover energy now dissipated in mechanical braking systems.

Turning to the actual apparatus used, the mercury-vapour converter is the most valuable current saving and technical innovation of recent years. In its original form (the rectifier) it could be used only for the conversion of alternating into direct current, but the development of grid control has opened the way for it to take the place of any type of rotating converter and the possibility of considerable savings can now be envi-

saged on alternating-current as well as on direct-current systems. In its simple application as a rectifier, it appears to be better in almost all respects than any of the rotating converters in use, but in its other applications it depends upon somewhat complex control equipment, the design of which, up to the present, has presented some difficulties.

Mercury vapour converters.

All three Reporters have devoted considerable attention to the mercury vapour converter and their reports should be consulted for descriptions of the construction of the various types available and of the theory of operation. Each Reporter has assumed the water-cooled steel tank unit to be the basic apparatus for traction use, but two of the reports mention the glass-bulb unit, as its characteristics make it suitable for some traction systems, while one Reporter describes a new form of rectifier constructed from steel but otherwise similar to the glass-bulb unit.

Attention is drawn in one report to the inadequacy of the nomenclature commonly employed. The word « rectifier » generally used when referring to a mercury-vapour rectifier, whatever its duties may be, actually describes only one of the uses of the apparatus and a new name is required to cover all the possible applications. The word « mutator » has for convenience been adopted in this one report.

Experimental or practical use of the mercury-vapour converter has been made for :

- (1) The conversion of alternating to direct current, i.e. as a rectifier.
- (2) The conversion of direct to alternating current, i.e. as an inverter.
- (3) The conversion of alternating current of one frequency to alternating current of another frequency and of either the same or another number of phases.

(1) By far the majority of mercury-vapour converters installed are used as rectifiers, and in new work they have almost entirely displaced other types of apparatus. When the mercury vapour converter is used as a rectifier, it is not necessary for it to be fitted with grid-control equipment, but the addition of this apparatus imparts features which in some cases may justify the increased complexity as it can be used to regulate the output voltage and to interrupt the direct current for protection against faults, either in the rectifier cylinder or in the output circuit. It is still too early to attempt to assess the value of these features and from the three reports the importance attached to them seems to vary.

(2) The principal use for the inverter will be found on direct-current lines using regenerative braking. Substations equipped with rotating converters are capable of handling power in either direction, but the rectifier substation cannot deal with regenerated power, and when regenerative braking is employed it usually becomes necessary to instal inverter units if the full advantages of rectifier operation are to be retained.

(3) The three-phase to single-phase rotating converters at present used on lines employing a single-phase contact wire and three-phase energy transmission, although satisfactory in operation, have a low maximum and all-day efficiency. For this reason the possibility of using a mercury-vapour converter is important, in particular because it would facilitate the interconnection of three-phase industrial networks and single-phase railway networks. There are a number of experimental installations, some details of which may be found in the reports.

The three-phase to three phase converter is of value in providing a flexible link between two independent three phase networks. Its application is per-

haps more in the field of industrial supply than in railway work.

None of the reports suggests that the efficiency of the mercury-vapour converter is likely to be materially improved, but as it is already of a high order, such improvement, if possible, would not be of great significance. It can be said that for any purpose it is already more efficient than any type of rotating converter available, even in the least favourable case, namely on low-voltage D.C. systems. Methods by which small improvements can be effected are mentioned. These include the control of auxiliary devices, so that they do not operate unnecessarily, and the use of particular transformer connections.

An essential difference between the mercury-vapour converter and a rotating machine is that there is no inherent storage of energy. This is a great advantage in that it renders the converter largely immune from damage under fault conditions, but it leads to difficulties when the instantaneous energy demands of the two coupled circuits are not identical as, for example, when converting three-phase to single-phase current. It would appear, however, that such problems are capable of solution by introducing reactors and condensers to absorb momentary energy differences.

The ripples present in direct current supplied by a rectifier may give rise to interference voltages in nearby communication or railway signal circuits. When these voltages are large enough to upset the proper working of the apparatus associated with these circuits, it often becomes necessary to fit the rectifier with output smoothing equipment, although in many cases the trouble experienced is small and can be overcome more cheaply by improving the balance and general efficiency of the affected circuits.

Transmission lines.

Transmission lines for the supply of energy to electrified railways may be

used entirely for railway purposes or may be used jointly with an industrial supply undertaking. Each arrangement has its particular merits, but the reason for employing a joint transmission system is to save capital cost rather than to reduce transmission losses.

It may be said that the exclusive use of transmission lines by the railways is best when the railway owns also the power stations, the output of which is wholly absorbed by the railway system and also on single-phase alternating current lines, where the energy is generated as single-phase. When the railway electrified system covers a wide area in which a large industrial load is also to be found, the advantages of common generating stations are considerable, and a common transmission system is then normally used. In the case of small electrified systems, power is almost always purchased and the transmission system is dictated by local circumstances.

Two of the reports mention the possibility of high-tension direct-current transmission and refer to the progress which has been made in the design of high tension rectifiers and inverters. Experimental units have operated successfully at 50-60 kv., but the powers handled have been relatively small and the conclusion is reached that direct-current transmission is not an immediately possible development.

On transmission lines supplying direct-current railways, the power factor is usually relatively high, and no attempts to supply wattless current at the load centres could be expected, but on the single-phase transmission lines of alternating-current railways the position is different as the inherent power factor of the single-phase commutating motor is low, and synchronous or static condensers may sometimes be installed near the load centres.

When a transmission network is supplied from more than one point, the transmission losses can be kept to a

minimum by the careful sharing of load and reactive power between the supply points in such a manner that each link in the network carries its correct proportion of the total load.

Corona and insulator loss is not a serious matter except at high voltages (above 100 kv.). It can be kept at a low value by suitable design of the transmission line. This implies good insulator design with guard rings to maintain correct potential gradients, fittings free from sharp radii, and conductors of large diameter. If necessary, this large diameter may be secured by the use of hollow cables.

Substations.

Apart from the question of conversion losses in substations, the number of substations in relation to the track length is of importance in reducing the losses in the contact system. This means that the total substation plant must be split up into as many small units as practicable.

On alternating-current lines the problem has been solved, in some instances, by the provision of feed points between the main substations. These usually consist of a single outdoor type transformer and associated control equipment fed from a feeder line running alongside the track. Such feed points can often be controlled conveniently from the nearest railway station.

On direct-current lines until recently, the plant used required continuous supervision, which made it economically impracticable to increase the number of substations. The introduction of the rectifier and the development of satisfactory remote-control apparatus have changed this situation; many railways have found the single-unit remote-control rectifier substation completely satisfactory and this arrangement can now be regarded as normal practice.

Automatic control can be substituted for remote control so saving the cost of

pilot wires, but operating difficulties which might arise under abnormal circumstances tend to prevent the widespread adoption of this method.

A number of railways using both direct and alternating current have introduced mobile substations in which the whole substation equipment is mounted on one or more trucks and can be moved from point to point to meet the demands of seasonal traffic or to maintain the supply in case of breakdown in a fixed substation. This scheme appears to offer definite advantages on lines where seasonal variations are large.

Regarding the efficiency of the plant used in substations, transformer losses are already very low and no material improvement appears possible except at prohibitive cost. As large units are somewhat more efficient than small ones the number of units should be kept as low as operating conditions permit. The losses in rotating converters either A.C. to A.C. or A.C. to D.C. are necessarily high and the only solution would appear to be the substitution of mercury-vapour converters. The possibilities of this have been dealt with earlier.

Contact systems.

The contact system is taken to include the return circuit from the train to the substation as well as the contact wire or conductor rail itself, and in attempts to reduce losses by increasing the cross section of conductors, it is necessary to consider both circuits if the best use is to be made of the material employed. Thus, particularly on direct-current lines, the economic limit to the total section of the contact wire or conductor rail is set by the resistance of the rails constituting the return circuit.

The resistance of the rail return circuit can be reduced by connecting the rails at the joints by copper bonds. On direct-current lines these bonds must be of heavy section and the cost constitutes a serious item of expenditure, but some

reduction has recently been effected by the substitution of bonds welded to the rails instead of the former pressed-in or expanded type. Experiments are being carried out in welding the rails themselves for purely mechanical reasons and the adoption of this would simplify the problem of rail bonding.

On alternating current systems where the voltage is usually between 11 and 16 kV., ohmic loss is less important and the design of the overhead equipment and the return circuit is dictated to a large extent by the need for avoiding interference with communication circuits. Rail bonds are not essential but frequently a light bond of the « signal » type is used. This reduces stray earth currents which may induce voltages on the sheaths of buried cables running alongside the track.

The third rail contact system is in use on direct-current systems up to 1 500 volts, which is apparently the practical limit of application. The ohmic loss in the contact rail is reduced by using special low-resistance steels, by increasing the cross section up to a maximum corresponding to about 150 lb. per yard and by using welded bonds at joints, or by making thermit-welded joints.

The overhead contact wire is used for the great majority of installations at 1 500 volts and in all cases at higher voltages. 3 000 volts is the highest value widely used, but a number of installations have been made at higher values; thus in 1913 a length of line now forming part of the London Midland & Scottish Railway was electrified at 3 500 volts and, in 1916 in America, 5 000 volts was used experimentally. There is a line in Italy operating at 4 000 volts at the present time. In these early installations there were technical difficulties in both the substation and in the traction motor design; the rectifier now provides a solution of the substation problem and the design of traction motors has been greatly improved, so the voltage limit is

set by economic considerations due to the higher cost of high-voltage motors and in some cases by difficulty in arranging adequate clearances for the contact wire equipment in stations and under bridges. When a railway uses a high proportion of multiple-unit stock and so has a large number of motors, 1 500 volts may be the cheaper, but when the traffic consists largely of heavy main-line trains hauled by locomotives, 3 000 volts is generally the cheaper.

It is apparent that on lines of more than one track, if the parallel running rails and the contact wires or conductor rails are bonded at points between the substations, advantage can be taken of the diversity of traffic on the lines. Such bonding represents normal practice on the running rails of all traction systems.

As far as the contact lines are concerned, bonding introduces complications under fault conditions in that more than one line becomes affected and it is not normally found on alternating current lines. On direct-current lines, however, the advantage to be gained frequently makes it worth installing bonds through switches or circuit breakers which are opened when one track has to be isolated. The circuit breakers are frequently of the high-speed type arranged to open automatically under fault conditions.

Feeder cables to reduce the resistance of either the conductor system or the track return are used to overcome local difficulties due to too great a substation spacing, but they are not generally employed when it is possible to space the substations correctly.

Rolling stock. *Locomotives.*

In the design of locomotives a certain minimum weight is essential on the driving wheels to give the adhesion required. An examination of data relating to older designs shows that the direct current locomotive quickly reached a stage of development where unnecessary weight

had been largely eliminated. In comparison, the alternating-current locomotive was heavier. It is here that the greatest change can be observed in recent years and there is now less difference between the weights of the two types. Further reductions of any magnitude cannot be expected and it appears that any which may be effected must be largely at the expense of that carried by non-driving wheels.

Where a reduction has been found permissible, it has been obtained by the adoption of higher speed motors, the more extensive use of welded construction and the use of special steels.

Many early designs, particularly on alternating-current lines, embodied a large single motor or pair of motors and rod drive. It was claimed that this gave a lower weight of electrical equipment and better adhesion than the alternative of one driving motor per axle. In practice, however, the lower weight of the fewer larger motors was offset by the need for a heavy frame to withstand the stresses set up by the rod drive and it has been found that locomotives with individual axle drive compare favourably as regards adhesion with rod drive locomotives, provided attention is paid to such points as axle load equalisation. As a result the rod drive has been generally abandoned for new locomotives on most railways, while where it is retained it appears to be done mainly for the purpose of standardisation.

Better use of the adhesive weight available can be achieved by the use of a « fine » controller. By making the controller steps small, the average tractive effort developed at starting can be made closer to the limiting value set by the possibility of wheel slip. Such controllers usually consist of a normal type controller and a supplementary controller arranged to pass through a complete cycle between each of the main controller steps. On alternating-current locomotives the arrangement is tending to

come into general use, but on direct-current locomotives, the problem of suitable design appears somewhat more difficult and less progress has been made.

Another valuable device for securing better adhesion on locomotives having non-driving axles is one which transfers some of the weight carried by the non-driving axles to the driving axles at low speeds and during starting. The device usually forms part of the axle load equalisation scheme almost universally employed.

Widespread attention has recently been directed to the question of streamlining, but so far as locomotives are concerned, it would appear to be of no very great value as regards energy saving unless the whole of the train is similarly treated.

Two of the reports refer to special locomotives which have been developed to use single-phase alternating current at 50 cycles. On one line there are two experimental units fitted with mercury-vapour converters.

Motor coaches.

In the case of motor coaches the adhesive weight is proportional to the weight to be hauled and any weight reduction which can be effected is of value. Apart from the lightening of the electrical equipment by adopting higher motor speeds etc., important changes in construction have been extensively introduced. These may be divided into changes in design and changes in material.

In regard to design, the aim has been to construct the underframe and body as a whole, so that the body in addition to providing a housing also carries a proportion of the stresses, and the use of welding has contributed to this end.

The new materials employed are aluminium and other light alloys, and special steels. The application of the light alloys has not required great changes in design but the full utilisation of special

steels can only be secured by the development of special technique.

Streamlining has been restricted largely to single-unit and set trains where it is of considerable value in reducing energy consumption on high speed schedules. In the case of multiple-unit trains in normal suburban service, questions of interchangeability with existing stock and the need for varying the train make-up throughout the day have restricted the application of streamlining to such points as rounding the ends of vehicles.

Roller bearings, by virtue of their low coefficient of friction, especially at low speeds, can give savings in energy consumption but except in the case of suburban services with frequent stops, it does not appear that the saving in itself would be sufficient to justify their extra cost. They have, however, additional advantages; in particular lubricating costs are reduced and almost all Railways have carried out trials which in some cases have led to their more extensive employment particularly on motor coaches. In locomotive operation, where questions of lubrication costs are of less importance, progress made has been smaller. They are more widely used on the axles of motor armatures than on coach or locomotive journals.

Stock used exclusively on electrified lines appears always to be heated electrically. The advantages in case of control and cleanliness as compared with fuel-fired boilers apparently outweigh the possible saving in energy despite the fact that on some lines it would amount to as much as 15 % of the total annual consumption. When stock has to run in both electrified and steam-operated territory, fuel-fired boilers are sometimes used in the electrified area to avoid the cost of fitting two heating systems.

In all cases reported the electric heating is under the control of the train staff, although the passenger compartments sometimes have an additional regulator to give reduced heating or to cut it out entirely. The duties of the train staff can

be simplified by fitting thermostats which limit the heating to a predetermined maximum temperature and in one instance it is reported that by this means a reduction of 45 % in energy consumption was effected. On alternating-current lines two or more voltages can readily be provided so that the maximum heating available can be adjusted to the prevailing weather.

In certain new stock the usual radiators are dispensed with and each coach is fitted with a system of ventilating ducts supplying air from a single heater. It is claimed that this arrangement can reduce the preheating time necessary before the stock is used by passengers and so reduce the energy consumption. As the energy demand of a train for heating is of the same order as its energy demand for traction, a material reduction in the peak demand can be effected by cutting out the heaters while the train is starting or ascending heavy gradients. While this method is not widely used it has been adopted on some lines.

Regenerative braking.

Up to the present regenerative braking has been employed only for speed control on gradients. For this purpose three-phase and single-phase converter type locomotives require no additional apparatus, but on other types gear weighing some 3 to 4 % of the total locomotive weight has to be added. In general, this extra cost and weight of equipment for regenerative braking can only be justified when there are long and relatively heavy gradients. The energy returned to the lines, although of considerable value is frequently of less importance than the reduced wear on the mechanical braking system and the additional safety imparted by the fact that the mechanical brakes are reserved for emergencies.

On direct-current locomotives the tractive effort developed during braking is usually approximately the same as that developed when hauling the train, but on single phase locomotives, if the motor

excitation is taken from the line, the resulting low power factor restricts the tractive effort which can be developed and it is then common to arrange for the locomotive to deal with its own weight only, the train weight being controlled by the normal mechanical brakes. This difficulty can be overcome by fitting separate exciters for the motors, but only at the expense of additional complexity.

Experiments are in hand with systems of regenerative braking which can operate down to very low speeds, thus enabling normal train stops to be made with little use of the mechanical brakes. Detailed information about these systems is not yet available but on one large City service the results so far obtained have led to a large-scale experiment which, it is anticipated, will effect a very large reduction in energy consumption and brake block wear. Such braking systems are, at the moment, confined to D.C. lines.

Measurement of energy consumption.

On steam-operated railways, it is a common practice to award a bonus to the Drivers and Firemen of locomotives on the basis of the coal consumed. The possibility of saving energy on electrified lines by installing suitable meters on the locomotives and giving similar awards merits consideration, although it must be recognised that the Driver of an electric locomotive has not the same degree of control over the energy consumption as the staff of a steam train have over the fuel consumption

Summary.

General.

1. Proposals for saving current cannot be considered on purely technical grounds, but must be related to the total cost to the railway of the service performed.

2. In addition to savings due to improvements in the equipment, which cannot be expected to make a great dif-

ference in the total energy consumption, direct savings in the energy required and in the recovery of energy by regenerative braking demand serious consideration.

Mercury vapour converters.

3. The most important contribution of recent years to the improvement of electric traction equipment, particularly as regards saving energy, is the mercury-vapour converter. In its full development it will tend to displace all types of rotating converters now in use.

4. For the conversion of alternating to direct current, the rectifier can already be regarded as the standard unit in new installations.

5. The mercury-vapour inverter has proved satisfactory for reconvertng direct to alternating current in the substations of direct current lines employing regenerative braking.

6. Theoretical problems raised by the use of the mercury vapour converter for the conversion of three-phase current to either single-phase current or to three-phase current of another frequency have been solved, but practical difficulties remain and present installations must be regarded as experimental.

7. Grid control equipment is an inherent part of the mercury-vapour converter for all uses except as a rectifier. In addition to its main function the equipment can be adopted to control the output voltage and to interrupt the main arc for protective purposes; in some cases it may be worth while adding it to a rectifier to give these features.

8. In cases where ripples in the output of a rectifier cause interference in communication or signal circuits, the provision of resonant shunt filters provides a satisfactory solution.

9. The water-cooled steel tank type unit is most widely used but the glass bulb type and also the newly developed low-capacity air-cooled type form useful alternatives for some applications.

Transmission lines.

10. A separate transmission system purely for railway use is best when the generating plant is used wholly for railway purposes.

11. A combined railway and industrial transmission system can be adopted with advantage when the railway network is widespread and covers territory having a large industrial load.

12. High-tension direct-current transmission, although offering possible transmission savings, is not yet commercially practicable.

13. Leakage and corona losses on high-tension transmission lines can be overcome by established methods such as the use of guard rings and hollow cables.

Substations.

14. The substations must be arranged to feed the contact system at a sufficient number of points to give a low contact system loss without unduly heavy construction.

15. On A.C. lines this can be effected by intermediate feed points between main substations in which simple, preferably outdoor, equipment is used and controlled either from the nearest railway station or by a remote control system.

16. On D.C. lines the same result can be obtained by the use of remote-controlled single unit rectifier substations.

17. The additional cost of remote-control as compared with automatic control is normally justified by the increased flexibility given to the system.

18. The mobile substation can sometimes be used with advantage to meet seasonal traffic fluctuations.

19. No appreciable improvement in transformer efficiency can be secured except at excessive cost.

20. The efficiency of rotating converting plant is inherently low; an improvement can be secured by the substitution of mercury-vapour converters.

Contact systems.

21. In reducing contact system losses,

attention must be given to both the rail return circuit and to the contact line or conductor rail.

22. On alternating-current lines, operating at high voltage, the contact system losses are readily reduced to a reasonable value and any special steps are usually needed to prevent communication circuit interference rather than to save current.

23. On D.C. systems the losses are higher, and special consideration must be given to the question of securing a reduction. Apart from increasing the contact line section or rail section, these include improved bonding by welding, and the cross bonding of tracks and contacts circuits.

Rolling stock.

24. The weight of alternating-current locomotives is now comparable with that of direct-current locomotives for similar duties, and in both cases questions of adhesion prevent any large reduction in weight. Some reduction can be anticipated from fitting « fine » regulators and devices which transfer weight from carrying to driving wheels during starting.

25. Streamlining of locomotives, as a means of saving energy is of relatively small value unless the whole train is similarly treated.

26. Weight reduction is the most important means of saving energy on motor coach stock. This may be attained by changes in construction and by the use of special materials. Changes in construction include the combination of the body with the underframe and the use of welding, while special materials may be divided into light alloys and high-tensile steels.

27. Streamlining is of value on high-speed trains, but questions of interchangeability and variable train make-up tend to restrict it to set trains and single-unit coaches.

28. Roller bearings are used as much to reduce lubrication and maintenance costs as to save energy; in consequence they are found more widely on motor coaches than on locomotives, and have been applied to motor armatures more frequently than to the locomotive or train axle journals.

29. The operating advantages of electric coach heating over fuel-fired boilers are such that boilers are normally adopted only in cases where the stock is hauled by both steam and electric locomotives, and they cannot be regarded as a means of saving energy.

30. The fitting of thermostats on electric heating systems, by assisting the train staff in controlling the coach temperature, often leads to considerable energy saving.

31. The use of a single electric heater in conjunction with a system of hot air ducts in each coach may be more economical than the fitting of a number of electric radiators, as the preheating time can be reduced.

32. In winter, the maximum energy demand of a train can be reduced by cutting out the heating system when accelerating or ascending heavy gradients.

Regenerative braking.

33. Present systems of regenerative braking which operate only above a relatively high speed, are of value only on lines having long heavy gradients.

34. Systems on trial on direct-current lines which operate down to low speeds and can be used in normal train stops may prove of considerable value in suburban service.

Measurement of energy consumption.

35. In suitable cases, the question of awarding bonuses to train drivers on the basis of energy used might be investigated.

SECTION III. — Working.

QUESTION VII.

Economical operation of the main line systems' secondary lines. Various methods adopted to adjust the operating facilities, safety measures, and station organisation to the volume of traffic,

by G. C. PALMIERI,
Special Reporter.

This question was made the subject of three reports drawn up respectively by Messrs. :

T. EMERS ⁽¹⁾ (Germany, Great Britain, Dominions and Colonies, Denmark, Finland, Norway, Netherlands & Colonies, Poland and Sweden ⁽¹⁾);

GRANDJEAN und GILMAIRE ⁽²⁾ (France and Colonies, Belgium and Colony, Luxemburg, North and South America, China and Japan);

G. C. PALMIERI ⁽³⁾ (Italy, Spain, Portugal and Colonies, Switzerland, Austria, Hungary, Czechoslovakia, Yugoslavia, Bulgaria, Rumania, Greece, Turkey, Egypt).

* * *

Although the Reporters sent out the same questionnaire to all the Administrations concerned, it was not possible to draw up the three reports in the same manner owing to the very variable nature of the replies received. Nevertheless, if the form is different, the substance of the three reports is much the same and this has allowed us to draw up a common summary.

* * *

I. — General.

The appellation « secondary lines » is applied in certain countries only to lines classified in this category by an Act of the Public Authorities; in others, and possibly the majority of them, such a classification is not official and the term « secondary lines » is applied to all lines carrying light traffic. In certain cases it would, moreover, be difficult to draw a line between secondary lines and local or district lines. As a rule, *secondary line* is synonymous with « line carrying light traffic » and all regulations as to construction or operation of lines considered as secondary are less rigorous than those adopted for main lines.

As a rule there are no special operating regulations applicable solely to secondary lines, but there are numerous attenuations of the general regulations and they vary fairly considerably from one Administration to the other.

All Railways are endeavouring to reduce expenses to a minimum and to create for their secondary lines an organisation better suited to the nature of such lines, above all to the volume of traffic and the particular requirements

(1) See *Bulletin*, November 1936, p. 1183/83.

(2) See *Bulletin*, November 1936, p. 999/1.

(3) See *Bulletin*, November 1936, p. 1129/29.

of the users. The steps taken are as a rule the following :

- elimination or restriction of the number of signals; discontinuation or restriction of the guarding of level crossings; reduction of the number of track inspection rounds; reduction of the number of general overhauls of rolling stock used solely on secondary lines;

- adoption of a simplified operating system : attenuation of the rules concerning the signalling in and out of trains, crossings and overtakings, the operation of points, shunting in stations, etc.;

- limitation of hours during which the stations are open to the public, both for passenger services and goods services;

- simplification of the organisation of station services as regards delivery or forwarding of goods, weighing and handling of parcels, the making up of carriage charges, accountancy, etc.

* * *

II. — Methods of transport used.

Economical operation of secondary lines is necessarily based as regards traction, on the adoption of suitable motive power.

Steam locomotives of a special type do not appear to be used as a rule. Mr. EMERS reports that on several British Railways there are, on certain branch lines, trains called « push and pull » which are made up of 2 or 3 coaches, a characteristic of which is that the engines (tank engines) can be driven either from the engine cab or from a driver's compartment at the other end of the train, placed in communication with the locomotive by means of special appliances running through three carriages at the most. Thanks to this arrangement, there is no need to move the engine, on arrival at a terminal, from one end of the train to the other. Push and pull trains are only staffed by a driver and

a fireman when there are only three coaches to a train.

Light trains.

In their report, Messrs. GRANDJEAN and GILMAIRE state that for a long while past the French Railways have operated, on their secondary lines in particular, short trains called « light trains ». The staff on these trains may be as little as a driver and a fireman on the locomotive and a guard on the train. When the driving of the locomotive does not require two men it is possible to dispense with the fireman, on condition that the guard takes place on the locomotive or has easy access to same whilst the train is running, and can stop the train in case anything happens to the driver.

In order to reduce the composition of trains, the French Railways have, as a general rule, done away with one class of carriage on trains on secondary lines.

In this respect it should also be noted that the Italian State Railways have for a long while past run light trains, i.e. very short trains (2 or 3 coaches) on which there is only one class, viz. 3rd. Sometimes there are two classes, 2nd and 3rd ; there are never any 1st class carriages or compartments.

Finally, the replies received show that Rumania uses on its secondary lines, besides other engines, special locomotives for negotiating curves of very small radius (114 m. = 5 3/4 chains) and that Yugoslavia also uses steam locomotives of a light type.

Railcars.

But it is to railcars that we must give the credit of having supplied valuable assistance as regards economy and improvement of services on secondary lines. Railcars appear to be particularly suitable for the operation of lines carrying light traffic, on account of their low working expenses : their high speed and other characteristics are also valuable items for working accelerated local

services and very fast services between large centres.

There are a large number of railcar types and, as will be seen from the three reports, nearly all Railway Systems have adopted them for their secondary lines.

The tabulations appended to the reports enumerate the characteristics of the various types of railcars in service on the Railways concerned.

The railcars now in service are as a rule used for passenger traffic. However, they have luggage compartments in which baggage and often parcels are also carried. Complete wagon loads are nearly everywhere worked by goods train. But in a few cases railcars are also used for hauling goods wagons. Seeing that the capacity of railcars is necessarily restricted, an endeavour is made to operate railcars to their full carrying capacity, in order to cope with traffic requirements, and it is therefore that railcars intended for secondary services usually only comprise one single class.

When the number of passengers is such that one railcar is not sufficient, additional railcars are run. This method may have the drawback of interfering with the train running schedules, especially as regards train crossing places. It is therefore preferable to couple one or two trailers to a railcar or two railcars together. With the new railcars it is, moreover, generally possible to adopt one or the other of these methods.

In order to avoid each railcar having a driving staff, when two or several railcars are coupled up, which would entail unnecessary expenses, it is possible to use appliances which enable the engines of the two vehicles to be controlled from one driver's compartment.

The running of twin railcars allows of vehicles of restricted power being used on everyday services, whereas the haulage of one or two trailers by a railcar requires the power of the latter to be such that the increased weight to be hauled does not entail any appreciable

reduction of the commercial speed. On another hand, the running of twin railcars or railcars hauling trailers is necessary not only for coping with passenger traffic peaks but also, in certain cases, for working express consignments of goods on secondary lines where no parcels trains are run and on which all passenger trains have been replaced by railcars.

A few Administrations use trailers of special design, of light weight, and provided with means of access to the railcars hauling them.

In conclusion, it may be said, in agreement with Messrs. GRANDJEAN and GILMAIRE, that railcars will have to possess :

(a) Sufficient capacity to amply meet normal requirements;

(b) Sufficient power to maintain a good commercial speed and, in certain cases, to haul a passenger coach or a goods wagon;

(c) Possibility of coupling two railcars together, with single control of all the engines by one man;

(d) Reversibility, in order to reduce the loss of time between arrival and departure, at terminal stations.

From an economic point of view, it is found that, as a rule, railcars are staffed by one driver and one guard, whose duty it is to assist the driver whilst the train is running or who, at any rate, must have access to the driver's compartment and be able to stop the train if the driver were to fail.

It should be noted that current maintenance of the railcars requires a specialised staff. Spare vehicles for running additional railcar services and for replacing vehicles under repair are always necessary. From this point of view it is advisable to concentrate a comparatively large number of railcars in one depot.

The cost price of the railcar-mile is as a rule appreciably lower than the steam-train-mile, even in the case of light trains. In France it is estimated that the

saving, as compared to light steam trains, is about 40 % in favour of railcars, in Denmark 50 %, in Germany 50 % or over.

From the replies received it is found that the advantages of using railcars are chiefly the following :

— development and even recovery of traffic thanks to the possibility of increasing the number of trips and stops;

— increased average train speeds, with a consequent acceleration of the traffic;

— possibility of effecting considerable savings in working expenses.

The drawbacks mentioned are :

— the difficulty and sometimes impossibility of coping with exceptional passenger traffic peaks;

— difficulty of ensuring an all-round goods service.

We have already mentioned the steps taken to meet these difficulties (coupling together two railcars, hauling trailers and running steam trains), but we feel that their importance should not be exaggerated because, when a railcar service is being organised, it is necessary to investigate beforehand the periodical traffic fluctuations as regards both passengers and goods. The railcar service scheme should be drawn up based on the results of this investigation, and the necessary steam trains should be kept in service.

* * *

III. — Safety measures.

General steps taken.

On lines carrying light traffic, or secondary lines, certain Railways have reduced the number of track inspections; similarly the rolling stock running solely on secondary lines is subjected to less frequent overhauls.

However, on the majority of Railways the rolling stock is not run exclusively on secondary lines and consequently the intervals between repairs remain the same.

Nor is there, as a rule, as regards regul-

ations concerning the braking, any difference between trains worked on main lines and those running on secondary lines.

The Austrian, Hungarian, Polish and Yugoslav Railways allow a shorter braking distance on secondary lines.

Finally, certain Railways prescribe speed limits for trains on secondary lines, these limits usually being between 40 and 65 km. (25 and 40 miles) per hour.

Level crossings.

The replies received show that most Railways are satisfied with guarding only level crossings where road traffic is very dense. Level crossings where road traffic is slight are as a rule left unguarded. In such instances the essential condition is, in general, that road users can be warned in time of the approach of trains.

Thus it is pointed out that on secondary lines of the Deutsche Reichsbahn, level crossings are not all guarded, but that visibility has been improved since 1930 on well defined lines, which vary according to the speed of the road traffic.

If the traffic is heavy, level crossings are protected by barriers or other means. An exception is made for crossings where there is good visibility and where trains only pass at a maximum speed of 15 km. (9.3 miles) per hour. At unprotected level crossings it is the rule to install warning crosses, the shape of which differs from that of signs placed at protected level crossings.

On the Netherlands Railways, in general, level crossings are not guarded and road users are not warned of the approach of trains.

The Danish Railways use, on level crossings where there is much traffic, barriers that can be worked on the spot or from a distance.

In Great Britain level crossings are usually protected by barriers worked manually by a gate-keeper or a signal-

man, and by signs as prescribed by the Ministry of Transport.

On the Swedish Railways automatic signals are used : furthermore when visibility is poor, special appliances are provided (barriers, light signals, bells, etc.).

The French Railways are considering the elimination in the near future of barriers at a large number of level crossings.

In Belgium, on lines operated on a simplified method, certain level crossings are no longer guarded; certain special safety measures have however been prescribed : drivers must reduce speed at level crossings and whistle, and appropriate road signs have been provided.

In Italy level crossings not guarded on the spot have barriers worked from a distance.

And finally, the general rule is that level crossings on secondary lines are not guarded in Austria, Switzerland, Egypt, Spain, Portugal, Rumania, Czechoslovakia and Jugoslavia. In many cases drivers have to whistle when approaching level crossings.

* * *

IV. — Technical operation of secondary lines.

Signals.

As shown by the replies received on this subject, on most secondary lines, the signalling has been reduced and in several instances done away with. This is a result of the application to secondary lines of a simplified method of operation, into which we will go shortly.

Mr. EMERS states in his report that on the Deutsche Reichsbahn home signals are not prescribed at crossing-stations on lines where the maximum speed does not exceed 40 km. (25 miles) an hour. Points and crossings on the open road need not be protected by stop signals or distant signals.

On the Deutsche Reichsbahn use may be made at crossing stations, in place of a home signal, of a disk signal in front of which all trains have to stop. This signal may be preceded by a distant disk signal.

On the Polish State Railways a simplified system of signalling is also in use.

On the London & North Eastern Railway, on lines to which light railway regulations are applied, approach signals are not obligatory, unless the stop signals (if there are any) cannot be seen from a distance of a quarter of a mile.

The Swedish State Railways use signals only at junction stations where several lines converge, and only when required by local circumstances. At other stations there are no signals but points and stop blocks are provided with a lock which can be opened only by a key carried by the train guard.

In their report Messrs. GRANDJEAN and GILMAIRE state that on the French State Railways, stations on lines operated by simplified signalling are not protected by fixed signals; they are protected at both ends by a distant sign board not lighted at night and showing the word « Station » to trains proceeding towards the station, and by a special post lighted by night and placed 100 m. (328') in advance of the leading-in points. When a driver passes a signboard he must be prepared to stop in front of the special post, in case of need. The speed for crossing station points is absolutely restricted to 30 km. (18.6 miles) per hour for passenger trains fitted with continuous brakes and to 15 km. (9.3 miles) for others.

On most of the other French Railways signals are no longer used at intermediate stations on secondary lines. The P. O.-Midi System has, in addition, generally reduced the signalling at block terminal stations, other than line terminal stations, to a fixed stop signal placed a short distance from the leading-in points, called a crossing signal (P.O.), or to a marker plate, lighted at night, carrying

a black stripe on a white background (Midi).

The speed of trains is restricted to 30 km (18.6 miles) between the points at either extremity of all establishments having no signals.

The Belgian National Railways Co. has done away with all approach signal. At crossing stations a more or less restricted signalling system is maintained.

On Italian secondary lines there are as a rule no approach signals : if the stop signals are not clearly visible, a fixed speed restriction signal is placed ahead. On many secondary lines simple stop posts are found instead of signals. The signals are lighted at night if there is any traffic; posts are not lighted.

On the secondary lines of the Swiss Federal Railways, home signals are required when the speed of trains exceeds 40 km. (25 miles) at junction stations and, in addition, when the speed exceeds 55 km. (34.2 miles) an hour at crossing stations.

Distant signals are only prescribed when visibility is really bad.

Simplified operating methods.

Simplified operating methods are in use on many Railways.

The Deutsche Reichsbahn states that on secondary lines operated on simplified methods a train may freely enter an unstaffed section or a staffed section without protecting signals if there is no crossing.

In other cases it can only enter after it has stopped and the guard has checked the route. Speed limits are prescribed for passing over trailable points and in other instances.

On secondary lines of these Railways there is a traffic-control station for one or more sections comprising several block sections regulating the succession of trains. At these stations there is a dispatcher who takes all the requisite steps regarding traffic on the section. Only important places regulating the succession of trains over the section are staffed

by an operating employee, all the others being considered as *unstaffed*.

In unstaffed stations the duties of pointsman, train-dispatcher, etc., are performed by the train guard. The signalling of trains between two control stations is usually done by telegraph or telephone. All stations regulating the succession of trains are also in telephonic communication with the dispatcher.

On British secondary lines traffic is usually regulated by technical devices such as blocks, bells, electric staffs with or without tokens, etc. Operation by means of a control station from which the traffic is regulated over a whole section is not very frequent.

The Polish Railways propose to regulate traffic on secondary lines by a « sectional controller » stationed in a *control station*.

Messrs. GRANDJEAN and GILMAIRE also state the French Railways apply simplified operating methods on a large number of single-track secondary lines. On most of the Systems these lines are divided into blocks at the ends of which are stations providing a complete safety service. Intermediate stations only have one track normally used for the running of trains. When any shunting has to be done there, the guard of the train unlocks the points by means of a key.

Intervals between trains are ensured by means of telephone communications.

Secondary lines on the P.O.-Midi Railways are worked by train-staff.

The Belgian National Railways Co. also uses a simplified operating method. The telephonic block system is used for regulating the succession of trains.

And finally, Messrs. GRANDJEAN and GILMAIRE report that in France, on lines operated by means of railcars, in order not to unduly interfere with the traffic in the opposite direction on single tracks, certain Companies run an extra railcar a very short time after the regular departure.

Traffic safety is ensured by using the

telegraphic block system between two runs in the same direction, the regular and relief railcars being considered as one and the same run.

In such instances, the relief railcar is ordered to run « at sight » and to slow down on sections where visibility is restricted. Railcars must be fitted with a device that automatically shows any application of the brakes.

On the Italian secondary lines traffic can be regulated in 3 different manners, viz. : in the same manner as on main lines; by an economical dispatching system : a single traffic controller on a given section; by a simplified operating system.

On lines operated on the single-controller system, the controller is the sole operating employee appointed to run the service on his section of line; the station staff are mostly private individuals to whom only duties of a commercial nature are assigned. Orders concerning the running of trains are given by telephone directly by the controller to the guard concerned.

Other Italian secondary lines carrying very light traffic are operated on a simplified system : only the most important stations are staffed by operating employees. The stations, which are called *control-stations*, have to regulate the traffic (by telephone) on the section of line under their supervision.

On most of the Czechoslovak secondary lines there is in force a *simplified train dispatching system* resembling the *single-controller* method to which we have just referred.

From the foregoing it will be seen that most Railways have adopted simplified operating rules and that several of them use control stations or an economical dispatching system for centralising traffic management in the hands of a small number of employees.

It should also be noted that on the majority of secondary lines, trains stopped on the open road have to be duly protected.

V. — Commercial organisation of stations.

From a commercial point of view, stations can be divided into 3 classes, viz.:

- those staffed constantly or periodically by regular railway staff;
- those that are staffed by private persons bound to the Railway by contracts (caretakers);
- those that are unstaffed (stopping points, halts, sidings, flag stations, etc.).

As a rule, most of the Railway Systems have stations of the three above categories.

Stations on secondary lines are generally open to traffic under the same conditions as stations on main lines. On certain Railways, however, the opening of certain small stations is limited to certain hours of the day (the times when trains pass or when the public is accustomed to travel).

Goods transport.

The carriage of goods is in most instances subjected to the same regulations as on main lines, viz. :

— in the case of *small consignments*, by the ordinary means (first available train, either passenger, goods or collector-train, and sometimes in the luggage compartment of railcars);

— in the case of *complete wagon loads*, by goods trains or by mixed trains, carrying passengers and goods. If traffic is light, goods trains sometimes run only certain days of the week.

Weighing.

The weighing of goods for ascertaining the charges is effected, in the case of small consignments, on scales with which stations are provided in all cases, and as regards complete wagon loads on weighbridges. If the departure station has none, then the weighing is done at a nearby station en route.

On certain lines, e.g. the Buenos Ayres

& Pacific Railway (Argentina), the weight declared by the consignor on dispatch is taken as the basis for transport charges, and it is only on arrival, after weighing, that eventual adjustments are made.

Making out charges.

The carriage rates are applied to consignments in various ways.

Certain Administrations use the same system as on main lines; others have simple charges made out by the stations which accept the goods and more complicated charges by centre-stations; others always have charges made out by centre-stations.

Accountancy.

As regards accountancy, a distinction must be made between staffed stations and those attended to by a caretaker.

The accountancy of staffed stations is almost invariably done by the station staff, according to general rules in force.

The accountancy of unstaffed stations is as a rule attended to by the nearest and most convenient station for this purpose or by accountancy centre-stations.

On this subject, Messrs. GRANDJEAN and GILMAIRE state in their report that as a rule on all the French Railways making out charges and accountancy work is done by the dispatching or destination stations. The so-called « simplified accountancy » system enables the Railway, at all stations where the duties to be performed do not require the whole time of an employee, to suppress most of the work in connection with the making out of charges and of accountancy, transferring the latter to a more important station called an accountancy centre-station.

We are also informed that the Belgian National Railways Co. has also instituted a simplified accountancy system and that the Reading Company (U.S.A.) has centralised the accountancy of all its stations at the Office of the Auditor of Freight Traffic.

Orders for empty wagons.

Requests for empty wagons are generally made as on main lines, if the station is staffed. At unstaffed stations requests are forwarded by its caretaker to a central station or to the traffic controller.

Management of stations.

One of the most appropriate measures for restricting the cost of operating stations on secondary lines is that of entrusting the management of small establishments to *auxiliaires* not actually belonging to the regular railway staff, but bound to the railway company by a contract. Railways which entrust the management of small stations to private persons only do so, of course, after submitting such people to an examination or at any rate after having proof of their honesty and capability.

These « caretakers » are usually considered as contracting parties and as a rule have nothing to do with the actual running of trains. They may, however, be entrusted with the working of barriers and signals.

Several Railways have also instituted stations not normally staffed and *halts* or *stopping points* which are not supervised by anyone and at which the service is restricted to passengers and luggage.

In such instances various methods are used by the Railways.

Tickets are possibly issued and luggage registered by the train guards.

On certain Railways, however, tickets are issued and luggage registered either by the first station after the passengers are picked up, by a junction station, or by the destination station. A few Administrations also have unstaffed *halts* which are open to goods traffic : either small consignments or complete wagon loads.

In such cases, consignors have to be present at the halt when a train stops, and it is the train staff which receive and handle the goods. The charges are

made out by a neighbouring station. On arrival the consignees, who are advised by the neighbouring station, have to be present and take delivery of the goods from the train.

Finally, Messrs. GRANDJEAN and GILMAIRE mention a few cases in which the train staff on trains have to make out the charges, collect moneys, keep returns in connection with the sale of tickets, the registration of luggage and the acceptance and delivery of goods. These are, however, quite exceptional cases.

In conclusion, we would mention that on services operated by railcars the driver does not as a rule take any part in the sale of tickets nor the handling of goods.

Working-hours.

As regards the question of working-hours, it appears from the replies received that they are the same as on main lines. The working-day varies from one railway system to another but it has to comply with the regulations laid down by the laws in force in the various countries. This duration is based as much as possible on the 48 hours-per-week system, but in case of intermittent work, the hours worked may be extended appreciably.

Summary.

1. The organisation of the different services on secondary lines should have as its aim the reduction of operating expenses to a minimum.

The fact should not be overlooked, however, that it is essential to improve the service as much as possible in order to meet the requirements of the public and recover, at least partly, traffic lost to road competition.

2. The possibility of reducing the expenses must be sought in the field of technical installations, in the domain of the methods of transport or in the adoption of simplified operating methods.

3. Technical installations should be

adapted to actual traffic requirements and not require any costly upkeep.

Simplification of signalling, and even elimination of signals where possible, simplification of the operation of points and other appliances, discontinuation of the guarding at certain level crossings, are all measures frequently adopted, which can be recommended with a view to effecting savings.

4. Substitution of more economical methods of transport for steam trains is one of the essential conditions for reducing expenses. From this standpoint, the use of railcars, when traffic conditions, either passenger or goods, are not against it, gives appreciable advantages.

5. Railcars have undergone a very rapid development which is worthy of being followed up. Owing to their low cost price they have made it possible to considerably increase the commercial speeds, to increase the train frequency and the number of stops, etc., in fact to greatly improve the working on secondary lines.

It is desirable, however, that railcars can be coupled and run as trains, or be able to haul one or two trailers.

6. Reduction of the train weight is another factor of economy. The use of light and short trains is a step strongly to be recommended. It is also advisable to restrict the number of classes on passenger coaches by abolishing first class and, where possible, also second class.

Careful use of the useful loading capacity of goods wagons is another means of effecting economies.

7. From the point of view of technical operation, it is recommended to simplify traffic regulations to the largest possible extent, and reduce the number of operations requiring the presence of operating employees. For this purpose, certain Railways have found it advisable to centralise the train control duties in selected stations or in dispatching offices.

8. From the point of view of the com-

mercial organisation of stations, we would stress the advisability of adopting simplified methods of making out the charges, and of accountancy.

9. Simplified methods of operation, rates application and accountancy make it easier, wherever possible, to commit the management of unimportant stations to private individuals. Such « caretakers », bound to the railway by a con-

tract, usually perform all station duties except those relating to traffic safety.

10. Finally, it is advantageous to convert certain small stations or halts into unstaffed establishments, tickets being issued and collected by the train staff, and the goods being forwarded or delivered — when such places are open to goods traffic — as if such places were private sidings.

QUESTION VIII.

Application of rational organisation (planning) to the transport of goods,

especially in connection with :

1. the functions and internal working of shunting yards;
2. the provision of inter-yard connections;
3. the estimation of the probable traffic to be dealt with, and the provision of the trains required;
4. the information to be given to the consignees;
5. the acceleration of the turn-round of empty stock;
6. the use of containers and rail-road wagons,

by Dr.-Ing. A. BAUMANN,
Special Reporter.

This question was expounded in three reports :

Report (Belgium and Colony, Egypt, Spain, France and Colonies, Italy, Luxemburg, Netherlands and Colonies, Portugal and Colonies), by Mr. J. COLLE (See *Bulletin* for October 1936, p. 1027/1);

Report (Great Britain, Dominions and Colonies, America, China and Japan) by Mr. V. M. BARRINGTON-WARD (See *Bulletin*, November 1936, p. 1113/25);

Report (Germany, Austria, Bulgaria, Denmark, Finland, Greece, Hungary, Norway, Poland, Rumania, Sweden, Czechoslovakia, Turkey, Yugoslavia), by Dr.-Ing. A. BAUMANN (See *Bulletin*, May 1937, p. 1191/41).

The more important facts given in the three reports based on the replies to the agreed questionnaire, for which we are mainly indebted to Mr. COLLE, are summed up below.

Generally speaking the three reports show that the goods service is organised on practically identical lines on all the Railways which sent in replies. The dif-

ferences consist in the fact that Railways with a great length of line and heavier traffic use on a larger scale methods which can be considered as rational; it may be noted, moreover, that the evolution of such methods has only made, in most cases, relatively little progress since the previous Sessions, when they were considered in a more extensive manner than in the present Question. The reason would appear to lie in the restriction, through competition and the economic crisis, of the freedom of movement of the Railways; the most pronounced development is in the use of containers, especially in countries where competition and the economic depression have obliged the Railways to fight most intensely to retain their traffic.

1. — The working of shunting yards.

A. — Splitting up the trains.

The operations in connection with splitting up the trains can be divided into two parts: preparation and the actual shunting.

The preparatory work may include :
preparing the cut list;
checking and marking the wagons;
getting ready to uncouple the cuts;
various records.

For *checking* and *marking* the wagons, the guard hands in with the wagon way-bills, a list showing how the train is made up, by loading and destination stations, for use in checking the incoming wagons.

The marking off of the cuts by destination, i.e. to ensure they are shunted unto the marshalling sidings corresponding to their ultimate destination is done usually at the same time as the arrivals are checked, but mainly by special staff.

Most Railways prepare *shunting lists* (cut lists) which indicate the successive cuts with the number of wagons in each and their destination siding in the order in which they follow each other over the hump. Any special points about each cut, such as loads to be shunted with care or requiring brakemen, are marked on the list. Moreover, the sidings column of the list is subdivided to show the sidings covered by the different men handling the slipper brakes.

If the guard's statement already shows the wagons in their proper order in the train and in addition to the destination (shunting siding), it shows for each wagon the gross weight, the braking weight, and if necessary the particular features of its load, no other outside operations are necessary and the cut list can be got out directly from the guard's list.

Copies of the shunting lists are distributed to the employee who supervises the shunting, the men handling the skids, the signalmen and men working the track brakes, and in certain cases to the driver of the shunting engine pushing the train over the hump. In this way the men handling the slipper brakes know in advance the sidings unto which the wagons will be shunted and their foreman,

by making suitable arrangements, can liberate any men not fully employed and use them where they are needed to brake cuts being shunted. Likewise, the signalmen and track brakemen know from the list what they have to do before the wagons come down, so that they can make the necessary arrangements, and if need be alter them during shunting, as for example when certain sidings already hold a large number of wagons. The lists handed to the drivers help them in regulating the shunting speed, especially when there is a great difference between the long and short cuts. These shunting lists can be considered the best method of communicating with the staff, and as being essential in busy yards. Their successful use depends on their being reproduced in large enough numbers.

When the cut lists are not made out, the number of the siding is chalked on the first wagon of each cut (*Hungarian State* and in some cases *Czechoslovak State*), or shunting labels are attached to the wagons (*Jugoslav State*).

On nearly all the Railways, the wagons undergo a *technical examination* as soon as they are in the reception sidings, so that all defective wagons can be withdrawn whilst splitting up the train, and the repairs or transhipment be accelerated. In certain cases, however, the wagons are not examined on arrival in small shunting yards as the defects found in addition to those reported during the journey are generally few in number, but instead the wagons are inspected on the outgoing roads so as to discover any damage to wagons (extant on arrival or sustained during shunting in the yard).

During the technical examination the continuous brake is tested by means of fixed compressed-air equipment.

Moreover, the practice on all railways is to *prepare the cuts of wagons* to be passed over the hump, on the reception sidings, by easing the main draw gear

and uncoupling the brake pipes, and, when used, the safety chains, between the cuts of wagons or individual wagons. The brake is also released. Previously, the wagons must be marked off with the siding number, in so far as the staff is not informed by the wagon labels.

The various formalities prescribed when shunting vary from one railway to another. They include checking the consignment notes and their stamping, classifying the consignment notes by destination station, and keeping records relative to the accountancy work in connection with the use of wagons, spotting delayed wagons, etc.

The shunting which follows the preparatory work includes :

on the one hand, cutting up the train, and,

on the other intercepting and braking the different cuts of wagons.

The *shunting properly speaking* in marshalling yards is done over a hump, in most cases by means of locomotives, in exceptional cases by gravity on sidings laid on an incline. The number of locomotives required depends on the layout of the yard and the rate at which the trains follow one another. Where the trains arrive directly at the foot of the hump, the locomotive takes at least 10 to 22 minutes from starting to deal with the first train to starting on the second; if the trains have first to be worked from a reception siding to the shunting siding, the time required, including shunting, can be as much as 30 to 40 minutes per train, according to the replies received to the questionnaire.

The shunting speed down the hump, which as is known depends on many factors, such as the gradient and height of the hump, arrangement of the points, atmospheric conditions, type of wagon and load, number of wagons in the cuts, etc., is on most railways equal to a walking pace. The figures reported vary between 0.5 and 1.0 m. (1.65' to 3.3') per

second, or between 6 and 10 wagons (without indication of length) per minute.

Most of the Railways control the speed down the gradient by four methods :

(a) Track brakes, some of a very simple type and others of a highly developed pattern, usually located at the bottom of the hump or in the upper part of the sorting sidings;

(b) Slipper brakes placed on the sorting sidings to stop the wagons close to those already collected therein;

(c) Brakesmen riding with the wagons, especially those which, on account of their loads, must not be rough-shunted, or relatively long cuts (of more than 12 wheels, for example).

(d) Intermediate braking after the wagon has run part of the way, then continuing at the lower speed with, between times, complete or almost complete stops until the final destination is reached.

The method including (a), (b) and (c) is used in most cases. Simple track brakes are usually operated each by one man; track brakes of an improved type, distance controlled, are worked in pairs by one man. Each slipper brake operator looks after two to four tracks.

Method (d) necessitates for the intermediate braking (1st line of braking) 1 man for every two tracks; to finally stop the wagons a brakesman deals with 6 to 9 tracks according to the speed of the operations.

As shunting lists are got out in almost all yards, the signalmen dealing with the shunting find them of assistance in carrying out their work. If the lists are distributed in good time the preparatory work can be started, and if any departures from the directions given in the list are required, joint action can be taken.

Uniformity in the essential features of shunting work proves that the present system is satisfactory from an economic

point of view. The more or less proper use of the staff, and of the locomotives, is frequently attributable to the train schedules and the services the trains are called upon to work; these two elements cannot be regulated with the same uniformity as, for example, the activity of an industrial undertaking. Consequently few attempts have been made so far to organise in a methodical manner, and according to harmonographs, the shunting of the trains and the other operations carried out in shunting yards; a special case of this kind is described in Mr. COLLE's report, pages 1031/5 and 1032/6, and our own report (pp. 1192/42-1193/43 and 1207/57) also mentions a scientific shunting method (not regulated by stages).

B. — Marshalling the trains.

The work involved in marshalling the trains is decided by :

(a) the task imposed on each train of serving certain stations as listed in the regulations on marshalling goods trains or in other similar instructions;

(b) the objective consisting in obtaining the quick turn-round of the wagons on important services; to achieve this, transferring wagons from arriving trains to suitable departing trains is laid down once for all in the wagon exchange regulations or prescribed in each particular case;

(c) the timetables, which necessitate the trains being ready in time.

If the trains are to be marshalled properly, the number, and in certain circumstances the weight of the wagons which are to make up a given train must be known. Many Railways use the waybills for this purpose, sorting them by directions and sometimes by trains as well. This method shows the wagons on the corresponding marshalling sidings. Other Railways report that they control the number and weight of the wagons in

the different sorting sidings, by continually recording the increases and decreases in the stock present.

Another method is to note every 3 to 6 hours, according to requirements, the number of wagons for the different destinations, giving particular attention to wagons requiring special attention.

The number of wagons to be dealt with must be known if the marshalling of the train is to be carried out methodically. If the number is large, optional trains can be run (see Chapter II); if there are few wagons coming in, booked trains may have to be cancelled.

As regards *the way train marshalling work is carried out*, the Railways have not given any information which differs from the methods reported in the technical press.

This work consists either in coupling together into a train several cuts of wagons marshalled previous to the shunting, or in re-marshalling the wagons accumulated on a siding and allocated to a number of destinations. Train marshalling work, unlike splitting up, can be carried out in connection with several trains at one time. Nonetheless the different trains should be dealt with in sequence order, so as to use the labour to the best advantage.

A number of operations in connection with the rolling stock, train operation or traffic (checking the couplings, testing the brakes, recording the train composition, examination of the stock, handing over the waybills, etc.) requiring 40 to 60 minutes, must be completed between the time the train is marshalled, and that of its departure.

On this point, too, no information deserving notice has been supplied.

2. — Train services between marshalling yards.

Long and short-distance trains run between the shunting yards everywhere. The short-distance trains serve all or

most of the stations between the shunting yards and only convey the through wagons from a shunting yard over lines of secondary importance to the next shunting yard. The main service between the shunting yards is generally provided by the long-distance goods trains which only stop to take water, change engines, or to be overtaken by passenger trains.

In certain cases trains making one or two stops at important stations or at junction stations where batches of wagons are exchanged, are run to make better use of the trains when the amount of through traffic is too small, or to speed up the working of the intermediate station by exchanging batches of wagons. Sometimes the question of attaching or detaching wagons depends on the tractive power of the locomotive or the brake power required on the different gradients.

In a general way, trains are classified into regular trains and optional trains.

1. The number, type and running times of the *regular trains* are fixed before each revision of the working timetables, according to the estimated (probable) traffic and the information received from connecting trains, and are printed in the working timetables and in the train-marshalling regulations. According to the size of the railway system, the departure times from the dispatching station, as far as possible late in the evening, and the time of arrival at the receiving station, preferably early in the morning, especially as regards parcels or other high-rated or perishable goods, are settled at the same time.

Other kinds of goods are also conveyed run during the night in many cases, as passenger trains are more closely spaced during the day. Only Railways carrying relatively light traffic incorporate the necessary goods trains in the day service, in order that trains reach or leave the marshalling yards at fairly regular in-

tervals, so that the service in such stations may be carried out in a uniform way.

The *number of regular trains* is determined on uniform principles with one sole variant: either the traffic on the least busy week day only is conveyed by regular trains, so that as far as possible no regular train has to be cancelled, but relatively many optional trains are required, or the regular trains are booked on the basis of the average traffic over a fairly long period, so that on the days with little traffic certain regular trains are cancelled, whereas on the busy days some additional optional trains have to be run.

In the second case care must be taken to see that the long-distance goods traffic does not suffer through cancellation of certain regular trains; consequently the Management of the Reichsbahn, and not the stationmasters, decides whether a train is to be cancelled when it provides continuous long-distance connections between goods trains.

Provision is made in nearly all working timetables for *optional trains* to convey wagons that cannot be forwarded by the regular trains. Special trains run at other than booked times, usually arranged by telegram as needed, are exceptional. Only a few Railways lay down the composition of optional trains when the timetables are being prepared; in most cases such trains are made up as required by circumstances.

As regards their *speed* and *weight*, and their composition, optional trains are dealt with in the same way as regular trains. The reports call attention to the general tendency there is to increase the number of wagons and the speed of goods trains; the economic value of fast bulk transport is recognised everywhere. The limiting values are about 60 to 65 km. (37.3 to 41.4 miles) an hour for 120 to 150-axle trains, and about 90 km. (56 miles) an hour for 80 to 90 axles.

The differences are due on the one hand to the varying size and organisation of the Railways and the varying traffic requirements, and on the other to the different conditions of the lines and their tracks, as well as of the vehicles and especially their brakes (solely or mainly compressed air).

The *decision to run optional trains* depends on the number of wagons in the station, which cannot be worked forward by the booked trains and of those due to arrive. Some Administrations run optional trains as soon as they are found necessary, leaving in from 2 to about 12 hours. Some Railways consider 3 hours the minimum in order to obtain good use of the locomotives. On the other hand other Railways announce several times a day, at given times, the optionals to be run; isolated specials are only run at intermediate times in special urgent cases.

The *number of optional trains* depends, on the one hand, on the principle on which the number of regular trains is decided, and on the other hand, on the traffic fluctuations on different days of the week. As regards the mileage run by optional or special trains compared with that of the regular trains, most Railways answering this question give a proportion of about 6 to 20 %; on many Railways, however, the number of special trains is equal to the number of booked trains.

Such differences are explained by the different conditions under which often used optionals are converted into regular trains. Some railways make an optional into a booked train at the end of a fortnight or a month during which the optional train has been run from 2 to 3 days to 5 to 6 days, whilst others make the change when re-issuing the timetables, or only very rarely convert an optional train into a regular one.

On most Railways a *minimum load* is laid down for the *optional trains*. On some Railways this load must be equal

to, or be a certain proportion of, that of the regular trains; other Railways require a minimum fixed load of say 200 to 300 tons. In cases where locomotives which would otherwise run light can be used to haul optional trains, the prescriptions on minimum loads are no longer complied with.

The working of optional trains and their load is under *special control* on many Railways. Generally speaking the stations only take the initiative in running optional and special trains in urgent cases; this initiative as a rule is taken by the train control office (dispatcher) or other operating organisation which, when a station asks for a special train, also has to supply a suitable locomotive with its set of men and arrange for it to work another optional train in the opposite direction. The arrangements made by these organisations are controlled on many Railways by special statistical returns of the loads of the most important regular trains and the optional trains.

III. — Estimation of the probable traffic to be dealt with.

It is extremely helpful, as regards the regularity of the service, to know as early as possible the traffic expected to arrive. A distinction has to be made between :

(a) traffic not loaded on rail, the consignor of which should give notice in advance;

(b) traffic already en route which has to be reported from station to station.

The question of *knowing in time the traffic to be provided for*, when it exceeds the normal, has not been solved satisfactorily on any of the Railways consulted. For certain traffic, such as that arising in the harvest season, or, for example in the case of coal supplies for the shipping companies, industrial undertakings and the population, estim-

ations as regards dates and destinations are not always possible.

The estimates must be based on information collected from the producers and consumers or from the public authorities. In the case of sea-borne traffic, as advance notices are available as to incoming or outgoing freight, the preparatory work can be done about a week before the goods have to be carried. This also applies to fixed-date industrial consignments.

If preliminary notices of this kind also affect neighbouring Railways, they are forwarded — only in certain cases.

No Railway possesses any general regulations on previous notification of new traffic or of isolated loads; there is no suggestion of drawing them up. In most cases statistics based on previous years have to be used.

It appears desirable that the Railways should be in close relationship — already extant in certain cases — with the official organisations engaged in discriminating and appreciating the evolution of the economic situation.

The advance measures to be taken to ensure the traffic being carried are particularly facilitated by certain rating measures in accordance with which on some Railways consignors of bulk goods such as ore, coke and coal in full train loads or by large batches of wagons, only benefit by the reduced rates provided they agree a monthly or fortnightly programme of their expected transport requirements.

As regards *traffic already handed over to the railway*, the notification is given nearly everywhere in one of two ways: according to the first, the advice notes showing the tonnage and the dispatching station is sent to the first shunting yard and subsequently from one calling station to the next until the destination station is reached; the second method is to send them from the dispatching station to a central office, to the traffic controller or the dispatcher

which in their turn advise the shunting yards en route as well as the destination station. These methods enable the shunting yards to always know eight hours in advance the large blocks of traffic to be dealt with and sent away.

Another basis in general use for quickly estimating the traffic to be worked is the demand for empty wagons. According to the replies received from several Railways, experience in the long run teaches just what local or general steps have to be taken as soon as the demands for empty wagons reach or exceed a certain figure within a more or less wide radius. On most Railways the allocation of empty wagons is dealt with from a central office, so that the steps to be taken to deal with traffic fluctuations can be taken rapidly and effectively by agreement between the operating services.

IV. — Information to be given to the consignees.

The tariffs and operating regulations require nearly all Railways to advise the consignee that goods have arrived, the method used generally differing in the case of ordinary goods, especially in full wagon loads, and for livestock and foodstuffs.

A. — Ordinary goods.

1. *Complete wagon loads* and parcels to be collected by the consignee are nearly always given notice of by the receiving station. The method of notification varies according to time and place, according to the size of the station, and frequently according to the agreements made with the consignees.

2. The *method of notification* is by telephone, telegram, or by a written advice sent through the post or by railway messenger. Except on a small number of Railways, the costs are charged to the consignee; unless a special arrangement has been made with the latter,

telegrams are not sent owing to the cost, except when it is a question of important loads, of considerable value, perishable, or explosive.

3. The *usual form of advice* is, in the absence of the telephone, a post card or letter: these are printed documents which the receiving station simply completes by adding certain special information about the consignment. Some Railways use advice notes which are generally attached to the waybill, filled in at the departure station, even partly by the consignor, and detached from the waybill at the destination station and sent to the consignee; on some Railways a copy of the waybill is used as the arrival advice note.

4. All these advice notes give the *time* within which the goods must be removed and after which demurrage will be charged.

5. Direct *advice* to the consignee *by the dispatching station* is not usual. The notification of arrival by the destination station is considered sufficient everywhere; this is done within one to three hours after the wagon is ready for off-loading. Wagons arriving during the weekdays in the evening, between 6 p.m. on certain railways and 10 p.m. on others and the opening of the station the next day, as well as those arriving on Sundays and holidays are only announced during the morning of the following working day except in cases of urgency.

When the documents have been sent on in advance (by passenger or fast goods train), before the advice notes are sent out care is taken to see that wagons have really arrived and are in position for being off-loaded.

6. The *usual commercial practice* is for the *consignee to be advised by the consignor* that the goods have been sent off. But this information does not enable the consignee to know when the consignment will arrive, except in the case

of short-distance traffic, unless he receives goods regularly and knows from experience the time the consignment will take, or when the consignment is worked to a definite programme agreed by certain Railways with the consignee in the case of important goods. In the latter case the notification to the consignee by the arrival station may be useless, although one of the Railways consulted thinks that the notice of dispatch makes it unnecessary to advise the consignee. Many consignors in certain countries have the bad habit of advising the consignee that goods have been sent off by rail before they have really been handed over. Such practice gives rise to many unjustified complaints from the consignees and it is often difficult for the Railways to clear themselves of these criticisms. Consequently, on one Railway the dispatch advice note sent to the consignee is a duplicate of the consignment note prepared by the departure station and the two documents leave on the same date. The destination station will not hand over the goods unless this document is produced.

B. — Livestock, foodstuffs and perishable goods.

1. In the case of livestock none of the Railways advise the consignee *when it is accompanied*; the man travelling with it is considered as authorised to take delivery, and the consignment is taken as having been delivered as soon as put into position for off-loading.

2. When the *livestock is not accompanied*, the consignee is advised as soon as possible, within two hours of arrival at most, even if outside normal working hours. The means employed are the same as those given in A-2 and 3; telegrams and telephone are used if much quicker. Occasionally the notification is prepared beforehand by the station on being advised by an intermediate station of the arrival of a consignment of this kind.

3. On some Railways a *preliminary telegraphic advice* is sent in connection with livestock and foodstuffs traffic, especially for live fish, shellfish, etc. All consignments of this kind are announced by the dispatching station to the receiving station or sometimes from one shunting yard to the following. One of the reports mentions that in the case of such loads, when so requested by the consignor and for a special charge, the name and address of the consignee are given on the advice note and the consignee is advised at his cost of the probable hour of arrival by telephone, telegram or a message from the receiving station. The arrival time advised is not guaranteed, although it is not likely to be much out. Consequently, independently of the preliminary advice the consignee is again advised in the usual manner of the actual arrival of the consignment, unless he has already called to take delivery. In a general way preliminary advices are not considered necessary, as if the consignment does not arrive or is not put at the consignee's disposal at the time fixed, compensation may be claimed for having uselessly caused the consignee to endeavour to collect the consignment or for loss or reduction in the profit on the sale (in the case of perishable goods).

C. — Determination of the time of arrival of the goods by the consignee.

A few Railways give all the train services, or at least the most important ones in the goods train timetables, sometimes reserved for railway use only, but also used to give information to clients. Some Railways publish timetables for the whole of the railway system, or at least for the guidance of consignors, certain information on the departure and arrival times of goods trains at important traffic centres. The public has to have a certain amount of practice to use these timetables. For this reason the notifica-

tion of the consignee of the actual arrival of the goods cannot be replaced as a general practice by referring him to the goods timetables.

V. — Acceleration of the turn-round of empty stock.

Nothing new in the way of speeding up the turn-round of empty stock has been reported since the Cairo Congress (1933) when this question was made the subject of a special investigation.

The following methods are in use :

1. On *railways with moderate traffic* and where there are no centres with heavy demands for empty stock, the wagons are distributed according to the stock available and the daily demand. The empty wagons are removed by ordinary goods trains.

2. The *large railway systems* have collecting stations to which the empty wagons are sent without special orders, so that the forwarding of these wagons to the consuming points is facilitated and accelerated. The empty wagons are attached as far as possible to through goods trains (i.e. those not stopping frequently).

3. When it is question of large numbers of empty wagons for *regular consuming centres*, permanent or temporary instructions are in force under which the empty wagons of all kinds or of special types are worked regularly towards such areas. Certain Railways will not allow empty wagons to be run in the opposite direction to this general direction, and enforce this regulation especially when there are heavy demands for wagons.

4. *Empty-stock trains* are run under the conditions mentioned in 3; the Railways on which the empty stock has to run a long distance also convey it regularly or according to requirements by other train services, even though the turn-round will not be the same, so as to

prevent the wagons standing uselessly, thereby involving unnecessary shunting and loss of time. The time spent on the runs by empty stock trains is the same as that of the goods trains and so is of great assistance thanks to the small proportion of stops.

5. To the measures taken to give an earlier arrival of the empty stock must be added that of *placing the wagons at the consignor's disposal* as quickly as possible. Nearly all the Railways report that the loading roads and sidings are drawn several times a day. Only a few Railways advise the consignors when the wagons are put at their disposal. The probable time it will take to supply the wagon is given in many cases when the wagon is ordered. Some Railways post up daily in the stations notices showing the consignors who have asked for wagons and those allocated them.

6. When the *wagons ordered cannot be supplied*, nearly all Railways advise the consignor by telephone or express letter.

7. As a rule the consignees are allowed a certain period to off-load loaded wagons after which demurrage charges are imposed; the consignees are nowhere required to state the time the wagons will be liberated. On some Railways when the wagons have been off-loaded the consignee advises the station personally or by telephone. In order to improve the turn-round of the rolling stock when the demands for wagons are heaviest, the following special measures are taken :

(a) Running successive special trains, the load of which may be reduced to about half the normal if this is possible without putting too much work on the stations.

(b) Drawing the loading points and sidings more frequently, whatever the number of wagons, so as to prevent the wagons being held up and to gain time for loading.

(c) Running goods trains on Sundays in addition to the normal timetables.

(d) Putting the incoming wagons in position very early and advising the consignees of the expected arrival time beforehand.

(e) Increasing demurrage charges when off-loading is much delayed.

All these measures assist in speeding up the turn-round of empty and loaded wagons. Certain economic principles justified and obligatory in normal times are deliberately ignored in favour of a punctual service giving general satisfaction.

VI. — Use of containers and rail-road wagons.

A. — Containers.

The extended or regular use of containers is only reported by a few countries, viz : Belgium, France, and Holland (Mr. Colle's report), Great Britain, United States, Japan, and Australia (Report by Mr. Barrington-Ward); and Germany, Austria and Rumania (Author's report). A number of countries are carrying out trials with containers.

On Railways using containers, sometimes the large, and sometimes the small container is preferred.

The large containers usually carry 2 to 4 tons, and in America up to 5.4 tons. Their useful capacity is about 3 to 5 m³ (4 to 6 1/2 cu. yds.). Most are covered, and in some cases the walls are insulated; the open containers, much fewer in number, are used chiefly for carrying building materials and fuel.

Large containers are carried by rail either separately or in groups (generally up to 5, in exceptional cases up to 12) on standard flat wagons or on four, six or eight-wheeled wagons, sometimes specially built to carry containers. The general design and the braking of container wagons are such as to enable them to run in fast trains.

Road haulage is by horse-drawn vehicles or by motor lorries. For transhipping from wagon to lorry, in most cases 6 to 7-ton cranes are used. Particularly satisfactory results have been obtained with mobile road cranes, with which it is possible to avoid the loss of time required to bring the container wagons under the fixed crane; also they are more flexible than gantry cranes.

The small containers as a rule have a useful capacity of 1 to 2 m³ (1.3 to 2.6 cu. yds.) and are either closed or open; their loading capacity is about 1 ton. There are also even smaller containers, of 0.25 and 0.3 m³ (9 and 10.5 cu. ft.) capacity, carrying 150 kgr. (330 lb.).

The small containers are used especially for consignments of parcels in fairly large numbers involving complicated packing. As the small containers are mounted on rollers or can be carried on trucks, they also facilitate the loading work very considerably, especially in tranship stations; in addition the risk of damage is lessened.

Some Railways also use small containers to group the consignments for various consignees in the same direction, so as to simplify transhipment.

Small containers are always carried by rail in covered trucks, if need be in common with other goods not loaded in containers. Containers holding goods of great value can also be carried in luggage vans of passenger trains. Small containers are carried by road under the same conditions as other goods.

Containers are put at the consignor's disposal at special rates applied to the goods to be loaded in the container, or are given on hire for a given mileage or time. In the latter case a reduced charge is made for carrying the container when empty. With very few exceptions the consignor carries the containers from and to the station.

It should be noted that some Railways do not put containers at the disposal of forwarding agents for grouped goods.

The *turn-round of the containers* is organised on the same lines as that of the wagons; the demands and stock available are balanced by the central control. The only differences are that on Railways using containers the method of checking the turn-round of special wagons is used for checking the total turn round of each container by means of card indices. Some Railways, on the other hand, obtain good results by allowing the containers to circulate freely. As in the case of empty wagons, the practice of sending the empty containers to certain heavy consuming centres is already in use.

Although the use of containers has not yet entirely left the *initial stage of evolution*, the results even now can be considered favourable. The advantages are: simplified loading of consignments without individual packing and easy transshipment of goods between wagon and lorry; the resulting saving particularly in the case of parcels carried in small containers; better protection of the individual consignments against damage. Undoubtedly these advantages considerably increase the ability of Railways to meet competition.

B. — Use of road-rail wagons.

Railway wagons are only carried by road in very rare cases.

Three systems are used: the Willème-Coder system in France (Nord, P.L.M. and State Rys.); a system without any special description in North America (Baltimore & Ohio Railroad); and the Culemeyer system in Germany (Reichsbahn).

In the Willème-Coder system, a covered four-wheeled wagon is enabled to run on the road by fitting the wheels of one axle with tyres. The other axle is lifted off the ground by the tractor which carries this end of the wagon. Tests over some months gave satisfactory results from a technical point of view; the wa-

gon behaved well both on the road and on the railway. As the road code was modified since the beginning of the trials, the useful load of the wagon had to be reduced to 5 tons for a tare weight of 14 tons. Under these conditions the Willème-Coder wagon loses much of its attraction; the tests made do not enable any definite pronouncement to be made so far on the value of the system.

The American system, in the tests made so far, consists of a large covered wagon on wheels with pneumatic tyres which are fitted outside the steel tyred wheels and do not revolve when the vehicle runs on rails. The tyres are simply deflated and the front wheels are locked. When the vehicles has to run on the road, the tyres are inflated by air from the brake. No information is available on the results of these trials.

The Culemeyer system uses very low road vehicles with rubber tyres which can be used like narrow-gauge railway carrier trucks to transport wagons of all kinds of up to 40 tons, and even 80 tons in exceptional cases, a long distance from the railway. A description of these vehicles was published in the February 1934 *Bulletin of the Railway Congress* and since then they have continued to give satisfaction, so that at the present time 37 of the 40-ton and 2 of the 80-ton vehicles are in regular service. The demands tend to increase the number of these vehicles, which are often called « rolling private sidings »; this seems to prove the practical value of the method.

Summary.

I. Organisation of the service in shunting yards.

In a general way, care should be taken that the organisation of train shunting and marshalling work meets the operating requirements; there is already great uniformity in the principles governing organisation of the work and the sequence of the operations.

2. The economical working of shunting yards depends first of all on the rational arrangement of the timetables. These should be drawn up so as to reduce to a minimum the time spent by wagons in the shunting yards; when the wagons are standing a very short time, better use is made of them and the number of wagons required is smaller. A proper succession of the trains, adapted to suit the capacity of the shunting yards, is also reflected in a better use of the shunting gangs and locomotives.

3. As exact a plan as possible of the work to be done in the shunting yards and the way it is to be carried out should be drawn up, both as regards time and work. The staff and locomotives should be allocated in such a way as to ensure their economical use; a sufficient margin must be allowed for frequent abnormal demands, whereas for cases of special demands, which rarely arise, the plan must be departed from. The plan should provide for suitable connections between arriving and departing trains.

4. The establishment of a working plan pre-supposes a knowledge of the time required for the different operations and the amount of labour needed to carry them out; the diversity of the trains and the variable density of the traffic affect the working time and the labour required so much that the unit values calculated from the average number of trains are not always, and in fact are rarely, sufficient for planning the work. It is not possible to get the whole of the shunting operations to strictly follow a regular rhythm owing the connections established by the timetables between the goods trains and those of the passenger trains. Consequently a satisfactory planning of the shunting operations must depend to a large extent on the particular circumstances of the moment.

5. Mechanical equipment, rail brakes, and automatic point operation have given excellent results in large shunting

yards; the operations are speeded up and the efficiency of the yards increased. On large Railways with heavy traffic, the train marshalling may thus be concentrated, the smaller yards especially at junctions only dealing with wagons for or from stations in their immediate neighbourhood.

II. *Train services between marshalling yards.*

1. If fast working is to be obtained, an essential condition is that marshalling yards be interconnected by trains which are not required to serve intermediate stations.

2. If the traffic arrive in sufficient quantities, it is recommendable to work it through to distant receiving stations, avoiding intermediate shunting yards, provided the time taken to collect the wagons in the shunting yard before departure is shorter than the time to be saved on shunting and marshalling in intermediate shunting yards.

3. If the quantities of wagons to be forwarded are small, so that the time required to collect a sufficient number for direct despatch to the most distant receiving station is too long, by making up lots of wagons which arrive at the shunting yard and marshalling them as they are into a train made up therein, all the work to be done can be completed as quickly or even more quickly if the time to collect them is appreciably shorter.

4. There should be enough regular trains to work the traffic experience shows may be expected, and to obtain, by good transfer possibilities, satisfactory through train workings in the case of long-distance goods traffic.

5. The optional trains required should be made known as quickly as possible in order to avoid delays in the conveyance of goods, avoid interfering with the working of the stations by blocking them up, and to make good use of the

locomotives and staff required to work the optional trains. The timetables for the optional trains should be prepared at the same time as those of the regular trains and be inserted in the working timetables.

6. The organisation of the special trains should not be left to the stations but be dealt with by a central office (traffic control, dispatcher) having wider jurisdiction.

III. *Estimation of the traffic to be dealt with and trains required.*

1. As regards the probable general trend of the traffic and the important individual loads, it is only possible to form an opinion some time beforehand by keeping in close contact with the consignors, by taking into account previous experience, by railway and economic statistics and — a relatively short time ahead — by the demands for empty stock; there is no standard method of solving these problems.

2. In the case of consignments already handed in for despatch, there are preliminary advice methods, either between despatching and receiving stations and marshalling yards, or through the medium of central offices which notify the information received from the departure stations to the other stations concerned and, in some cases, to neighbouring Railways.

IV. *Advice to be given to the consignees.*

1. Nearly everywhere the consignee is advised of the arrival of his goods and of the fact that they are ready for off-loading so that the wagons, sidings, and loading platforms can be made available again as quickly as possible.

2. No account is taken of the fact that the consignee, according to general practice, is informed by the consignor of the day and hour of departure and consequently can calculate the probable day and hour of arrival, from his own expe-

rience or with the help of a goods train timetable or similar documents.

3. When the demands for wagons are heavy, the advice notice — together with the intimation that the period within which the goods are to be unloaded is shortened, if need be — is particularly important; the preliminary advice, by the last station of call to the receiving station, of the probable time of arrival of goods of some importance is to be recommended.

V. Acceleration of the turn-round of empty stock.

The turn-round of empty stock is accelerated by the following methods, the application of which depends on the particular conditions of the railway concerned and the kind of traffic worked :

(a) Concentration of the empty wagons at large collecting centres from which they can be distributed to the consuming points;

(b) Working empty stock towards the regions generally short of wagons without special demands having to be made;

(c) Working the wagons in special empty-stock trains, which do not shunt in the marshalling yards and avoid all unnecessary stops. These very light trains are formed with the maximum number of axles and their timings adapted to the small weight hauled;

(d) Authority to reduce the load of empty-stock trains and loaded-wagon trains below the nominal value when there are heavy demands for rolling

stock, and so reduce the turn-round times in a general way; at the same time, loading points served more frequently, and users given a preliminary advice of the time the loaded or empty wagons will be at their disposal.

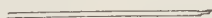
VI. Use of containers and rail-road wagons.

1. Very few Railways have left the experimental stage as regards the use of containers. It appears that the questions of the rates and conveyance between the railway and the consignor's or consignee's premises can be solved satisfactorily.

2. In many cases the use of the large container is still hampered by the difficulty of transferring it from the wagon to the lorry and inversely, owing to the lack of suitable cranes, and the fact that other simple means of transfer between the two means of transport have not yet been perfected. Small containers used for parcels and special small consignments appear to be advantageous, especially from the point of view of the reduction of transhipment operations.

3. Undoubtedly, the use of containers for door to door transport has an extremely favourable influence on the ability of the railway to meet competition.

4. Road transport of railway wagons is only at present in use on a very few Railways. Although it has been used on a fairly large scale with good results, no definite judgment can be formulated on the subject as yet.



QUESTION IX.

Results obtained from the automatic and distant operation of signals and points, and from locomotive cab signals,

by Messrs. TUJA and LEMONNIER,

Special Reporters.

Question IX was dealt with in three reports, drawn up by Messrs. :

BELLOMI and MINUCCIANI ⁽¹⁾ as regards Italy, Switzerland, Yugoslavia, Bulgaria, Rumania, Greece, Turkey, Egypt, Spain, Portugal and Colonies;

MISZKE ⁽²⁾ (Austria, Czechoslovakia, Denmark, Finland, Germany, Hungary, Netherlands and Colonies, Norway, Poland, Sweden); and

TUJA and LEMONNIER ⁽³⁾ (France and Colonies, Great Britain, Dominions and Colonies, Belgium and Colony, Luxemburg, North and South America, China and Japan).

As these reports follow the same lines, it will be sufficient to review briefly any particularly important points, stressing those showing a divergence of principle between different Railways.

We will end with the summaries which, in our opinion, can be drawn from these investigations.

* * *

It should be remembered that as the question covered the whole field of modern signalling practice, the reporters preferred to examine principles and regulations generally speaking, rather than

to describe the equipment and installation.

PART ONE.

Automatic block.

The Railways unanimously consider that on busy lines the automatic block is an excellent method for ensuring the proper headway between trains running in the same direction, both as regards safety and as regards improving the capacity of the line.

Exact meaning of the block signal at danger.

All Railways normally require the driver to stop his train at a block signal at danger. Most Railways authorise the driver to restart at once and pass the signal, the driver being required to run with caution as will be discussed later. (Some Railways even allow certain heavy trains to pass without stopping certain block signals at danger, when climbing steep gradients.)

Some Railways only allow the train to proceed at caution after a few minutes' stop.

Lastly, some Railways only allow the train to restart after an authorization has been received by telephone from the next station or control post. This permission then states the conditions under which the train is to proceed, i.e. at caution or at normal speed.

All three methods are doubtless acceptable, and it is quite understandable that, as regards rules and regulations, which

(1) See *Bulletin of the Railway Congress*, April 1937, p. 789/35.

(2) See *Bulletin of the Railway Congress*, April 1937, p. 1089/103.

(3) See *Bulletin of the Railway Congress*, January 1937, p. 137/1.

are governed to some extent by psychological factors the Railways are led to follow different practices to suit the habits and mentality of their staff. Personally we prefer the first method. Working a train into an occupied block section may undoubtedly cause an accident if the driver fails to obey the order to run at caution given him when passing the signal. Now, it is not *always* possible to prevent running into the section in this way, if only because of the telephone near the block signal getting out of order. Under such conditions we think it would be best to accustom the drivers to running cautiously by authorising them to proceed immediately after they have brought the train to a standstill at the signal at danger. This method has the further advantage of keeping down to the minimum the time lost by trains meeting a signal at danger. It must not be forgotten, moreover, that if being late is not sufficient to cause an accident, it can nonetheless provide the occasion. It is therefore directly in the interest of safety that these delays be reduced to the minimum.

We even think that certain heavy trains should be authorised to run, without stopping, past certain signals at danger on steep rising gradients, naturally at caution. One might even be tempted to authorise all the trains to run past all block signals at danger, without stopping. In theory this would be quite compatible with safety; but we consider that in practice it would have certain drawbacks, as an order to run at caution is more easily respected by the drivers when they are given it after stopping (or at a very low speed) than when they receive it whilst running at speed. No Railway, as far as we know, has gone to this length.

* * *

When the train is restarted under instructions to run at caution, how

should the driver handle it? Usually — as he should expect to overtake a preceding train stopped in the section — he runs « at sight », i.e. he adjusts his speed in such a way that with the brake power available and the length of track he can see, he can stop before meeting any obstacle or any signal which compels him to stop at once.

Some Railways limit themselves to this requirement; others, on the other hand, require the driver to run at a reduced speed (8 to 25 km. = 5 to 15.5 miles an hour, according to the Railway). This double obligation to run at a reduced speed when running at sight has some advantages, but is it not attended with the danger of inciting some ill-trained drivers to commit the fault of believing they are running at sight when they observe the maximum speed laid down? This would be a serious case, as the maximum speed in question on nearly all the railways is too high to correspond with that allowed when proceeding with caution, at least on certain difficult sections, or in foggy weather. Moreover, it is not possible to fix this limit low enough for it to be actual running at sight under the worst conditions, without the serious disadvantage of reducing too much the speed of the trains in most cases and thereby causing useless delays.

Our preference, therefore, is for the simple system of not imposing any speed limit in kilometres per hour on trains running past a block signal at danger, but only to require them to run « at sight » as defined above.

Protection of stationary trains.

Should a train stopped accidentally on a line equipped with the automatic block be considered sufficiently protected by the following train running at sight, as required, by the block signal being at danger? Or should the train men in addition protect their train by detonators and hand signals?

The solutions adopted by the different Railways vary much. Some Railways never require the train to be protected; others prescribe it as if there were no automatic block, whilst others only require it when the time the train has stopped exceeds a certain period. Amongst the Railways requiring the train to be protected, some of them lay down the same distance as though there was no block; others, contrariwise, are satisfied with a short distance. Finally on some Railways the trains need only be protected when the guard thinks there is danger of it being overtaken by another.

Here again — at least in the case of short sections, for example less than 3 km. (1.9 miles) long — we prefer the simpler solution consisting in never requiring protection (except, of course, in the exceptional case of derailment or when there is danger of the automatic block getting out of order). We think that the absence of protection is the most effective method of obliging the drivers — who then have to rely on themselves — to respect *scrupulously* the obligation of running at sight. There is no doubt that this obligation is an important factor in safe working.

Steps to be taken against possible failures of the automatic block.

These failures can result from various causes :

(a) A signal unduly remaining off, although the corresponding relay is correctly de-energised.

This is practically impossible with daylight signals.

On the other hand, though this is very rare with well-designed equipment, it is not impossible in the case of mechanical signals with a semaphore arm or a rotating disc. Some Railways, in order to meet this drawback use a « continuity » arrangement which prevents

the block signal being taken off until after the following block signal is at danger, if this condition is not fulfilled or until the second section is cleared. This arrangement is valuable in the very exceptional case of a block signal unduly remaining at line clear. Against this it has the drawback of increasing the number of failures causing the block signal to remain unduly at danger; in addition, it makes it necessary to require the trains to be worked at sight over *two* sections instead of only one, in the case of every driver passing a block signal at danger, and in our opinion this is regrettable, on the one hand because time is lost uselessly and on the other, because the number of cases in which the driver meets no obstacle in a section through which he has to run at sight is considerably increased. There is then obviously the risk of reducing the care with which running at sight is in practice carried out by the driver.

Therefore, we think finally that if the continuity is considered recommendable in automatic block equipment with mechanical signals save in exceptional cases light signals should be used exclusively this being moreover very desirable for many other reasons, the first being the simplification of the signalling.

(b) A relay, after a train has passed, might continue to make its upper contact although not receiving any current.

Here again some Railways use a continuity device similar to that in the preceding case, preventing the block signal being taken off if the track relay of the following signal has not been correctly de-energised by the passing train. This arrangement has advantages and drawbacks of the same order as those of the continuity device mentioned above; for the same reasons we personally consider, in view of the remarkably regular working of present-day relays, that it is reasonable not to include it in modern installations.

Following the same trend, some railways have considered it desirable to duplicate the block relays. This system has the advantage over the continuity device of not requiring running at sight through two sections; against this, like the continuity device, it increases the number of times the block signals unduly go to danger, which is a drawback; finally, and chiefly, this system is costly, especially if we note that doubling the relays necessarily shortens the maximum length of the track circuits. Consequently we think that, like continuity, the doubling of the relays is usually not to be recommended.

(c) A relay could receive current unduly, in spite of a train running through the corresponding section.

The causes of such an incident are many: the most probable are stray currents from an outside source, and the circulation of light vehicles or vehicles with pneumatic tyres which do not short-circuit the two rails properly. The remedies are many; it is interesting to point out that the coded current block supplies a means of improving the safety in this direction appreciably.

* * *

PART TWO.

Power boxes.

General.

Most of the Railways consulted only use power boxes with *individual levers*, i.e. in which a lever corresponds to each apparatus in the field. Many of them are endeavouring to reduce the number of levers in the boxes by using one lever to operate several signals. Messrs. BELLOMI and MINUCCIANI's report contains a detailed account of this matter. These individual-lever boxes give complete satisfaction.

The same can be said of the power boxes with *route levers*, used especially

in France, boxes in which it is possible to obtain by a single lever the operation of the whole of the signals and points of a route. It appears that this type is particularly convenient for the signalmen.

Whether dealing with signal boxes with individual levers or route levers, « miniature » levers (of very small dimensions) are sometimes used. There are also levers (this is generally the case with miniature levers) which are not interlocked properly speaking, viz. can be moved by the signalman, even when they correspond to equipment which should not be moved at that moment. Naturally the apparatus in question do not then follow the movements of the lever, their control being cut off by a relay. It appears that this method of interlocking the apparatus in the field is at least as reliable as immobilising the control lever by interlocking.

Safety conditions generally provided.

All the railways consulted generally agree on the safety conditions required from power-operated boxes. As a rule in these boxes are found:

— automatic protection of the trains standing in the signal box territory;

— indication locking of levers, preventing a signal being taken off if the corresponding points in the field are not in the correct position. This control is sometimes temporary, i.e. it only exists at the moment the levers concerned are operated. It is more often *permanent*, i.e. no signal can remain off unless the points concerned are in the proper position;

— route locking (or transit locking), intended to prevent the passage of a second train before the first has left the territory controlled by the box, or at least that part of its route which should be free for the second;

— approach locking, preventing the movement of the whole of the apparatus

run over by a train as soon as this train approaches a distant signal protecting this route.

Failures.

On the other hand, the opinions of the Railways consulted differ much on the question of the steps to be taken in the case of failure of an electric device, which thus prevents the operation of a point or a signal. The necessary action is taken, on certain Railways, by one of the men responsible for the maintenance of the apparatus, and on others by the signalman, and on still others by someone over the pointsmen.

After the device out of order has been cut out, some Railways allow the trains to pass at speed; others on the other hand require all the trains to stop. Finally, some Railways are satisfied with cancelling permanently the device out of order, whereas others prefer a « repeating » system, only cutting out for the passing of one train, and having to be operated the whole time the equipment is out of order before each train is allowed to pass.

These various methods have advantages and disadvantages; our preference is for the signalman to cut out the defective part, and for the trains not to be allowed over it at speed the whole time the apparatus are out of order.

Long-distance operation of points with devices for reducing the number of operating and control circuits.

These devices, which give excellent results wherever used, are chiefly employed in America. We are convinced that their use will be extended in other parts of the world. In our opinion, it is interesting to consider their use when the line gets overloaded. They are particularly valuable in the case of single-track lines, as they make it possible to simplify to the maximum the operating regulations and to operate the whole of

the traffic by signals placed under the direct control of a single man for the whole of the line (centralized traffic control). These arrangements, in conjunction with the automatic block, often make it possible to avoid doubling a line carrying heavy traffic, by limiting this work to the sections on which the expenditure is low, the whole of the line being still controlled by one employee.

Automatic operation of the equipment.

Finally in certain simple cases, it is possible to go still further and have the signals and points operated by the approaching train.

* * *

PART III.

Cab signals.

General.

Undoubtedly, on very heavily loaded lines as well as with high speed trains, the driver's duties should be simplified by fitting signal repeating plant, or continuous signalling on the engines, the equipment being arranged in such a way that there is no risk of the driver's vigilance being diminished, which is an important safety factor.

When such equipment is fitted on the engine, a second question arises. Should the driver simply be given information as to what he should do, or is it necessary to go further and provide automatic braking, acting *in place* of the driver if the latter has not acted correctly?

Signal repetition.

The essential indication to be repeated on the engine is obviously the distant signal at danger.

It can be interesting, especially as a means of checking the condition of the equipment, to repeat on the engine the taking off of the distant signal.

The repeating equipment can be of many types according as the indications are transmitted to the locomotive by purely mechanical means, or electro-mechanically, or by an electrical non-contact method (inductive).

The former, with purely mechanical transmission, have been tried for a long time, and experience shows that they are not satisfactory, except at low speeds.

The second, arrangements for transmitting electricity by means of a contact, can be divided into two classes. Some give the danger indication by the current being cut off; this sort is by far the best. The others give the danger indication by emitting current; any defect (broken wire, loose terminal, lack of current, etc.) prevents this emission of current and means that the driver has no indication that he is passing a signal at danger. Such equipments should therefore receive particularly careful maintenance.

Non-contact devices are markedly better than the other systems just mentioned.

Continuous cab signalling.

Continuous signalling is essentially different from signal repetition. Instead of giving the driver information when passing certain points of the track (actually where there are signals) and at those points alone, continuous signalling gives the driver information on the condition of the track *all the time*, and not only at the track signals, which in our opinion should be kept in service.

There is nothing to prevent the driver being given more indications that he can get from the permanent way signals. For example, with three-indication track signalling (line clear, caution, stop) four indications can easily be given on the locomotive (line clear, advance warning, caution, stop). This is of particular value in the case of a section of line run over by some ultra-fast trains, for

which the track signals have become inadequate.

Comparison.

From the point of view of safety, continuous cab signalling appears to be superior to simple signal repetition, even when the latter is effected by means of the most modern non-contact (inductive) devices. Continuous cab signalling is at any rate much more advantageous from the operating point of view than signal repetition in the case of heavily loaded lines. This is due in particular to the fact that the driver can regain his speed *at the very moment* there is no objection to doing so, whatever part of the track he may be on at that moment.

Against this, continuous signalling means equipping the line with the automatic block, and is therefore much more costly than the best repeating systems, on lines which are not already fitted with the automatic block. The question of knowing whether it is desirable or not to use it on a given railway system is, therefore, dominated by the work done by, or the intentions of, the Railway as regards the automatic block. Any railway owning, or providing for, the automatic block on a large scale should, in our opinion, if it desires to help its drivers to observe the signals, consider continuous signalling on the locomotives. Contrariwise, a railway without the automatic block, which is not considering installing it, will rather provide cab repeating equipment, preferably of the non-contact type.

Automatic braking.

There is no difficulty as a rule in providing automatic braking when danger signals at *stop* are run past. However, this will not secure safety unless the signals are always far enough from the obstacle for the brake, when applied in line with the signal, to stop the train before the obstacle; this position does

not normally arise except in the case of lines over which the trains run at low speeds.

On the main lines, contrariwise, automatic braking has to be brought into action when passing the distant signal. Two methods can be used :

The brake can be applied every time the distant signal is passed at danger, whatever the speed of the train. Obviously, in this case the driver should have some means of preventing the train being brought to a standstill when this is unnecessary; he is therefore given some means of cancelling the braking action and, therefore, in the definite case when the driver and fireman are not both unable to operate the brake, everything takes place as if the engine were only equipped with cab repeating signals.

Automatic braking can also be used in conjunction with a device controlling the speed of the train; this braking is only put into action when the driver does not obey the signal indication correctly. Unlike automatic braking independent of the speed, this system, which is much more complicated and costly, provides safety in case the driver, having passed a warning signal at danger which he has perfectly seen, subsequently believes, by mistake, that the corresponding stop signal is off. It should be noted that this mistake on the part of the driver is not likely to occur when the engine is equipped with cab signals.

SUMMARY.

Automatic block.

1. The automatic block, on heavily loaded lines, is an excellent means of providing adequate headway between trains running in the same direction, as regards both safety and the capacity of the line.

2. The block signal at danger should generally necessitate the train being brought to a standstill. It appears advan-

vantageous, however, to allow certain heavy trains to run past certain block signals at danger, on steep rising gradients, without stopping.

3. After stopping (or exceptionally without stopping as mentioned above) the danger indication of the block signal should mean that the driver is to proceed with caution. There appears to be no objection to the train restarting immediately without further ado, as is done on many Railways.

4. A driver proceeding with caution when he has met a block signal at danger should run « at sight », i.e. at such a speed that at any moment he can stop on the length of line in sight.

Some Railways require the driver, in addition to running at sight, not to exceed a given hourly speed. It may be questioned whether this speed limit, besides some advantages, has no drawbacks. In any case, it can be dispensed with.

5. In short sections at least (not exceeding 3 km. = 1.9 miles) a good method of protecting trains stopped on the open road is to rely on the block and not to require the staff on these trains to resort to additional protective measures (except in case of derailment).

6. In the case of the automatic block with mechanical signals some Railways consider it prudent to provide a « continuity » device which maintains a block signal at danger after the corresponding section has been cleared, in the exceptional case in which the following block signal has not gone to danger after a train has passed.

This measure gives certain guarantees but has some drawbacks. The best solution appears therefore to use light signals instead of mechanical signals whenever possible.

7. Whatever type of signal be used, even in the case of light signals, some Railways deem it necessary to take pre-

cautions (double relays, or continuity devices) against the exceptional case of a block relay not becoming de-energised when a train has passed, whereas other Railways, chiefly to reduce the number of times the block signals unduly go to danger, take no such additional precautions.

The essential thing is to use excellent relays only.

8. The coded block, although in use only a short time, appears to be a particularly safe form of automatic block.

9. Conditions under which light vehicles as well as vehicles with pneumatic tyres can be allowed to run over automatic block sections with safety still require investigation.

Power boxes.

10. Power boxes with route levers, in which one lever operates the whole of the points and signals on a route, appear to specially facilitate the working.

11. At the present time there is a tendency to use very small (miniature) levers and replace the interlocking properly speaking, i.e. locking the levers into position, by directly cutting the operating circuit of the apparatus in question by means of a relay. These new methods seem to be at least as safe as those used in power boxes of other types.

12. Power boxes lend themselves particularly well to providing all the safety conditions that can be desired. It is to be recommended that provision be made in these boxes for section locking, point locking, route locking, and approach locking.

13. Issuing instructions covering the failures of electric devices preventing point or signal movements in a power box is a delicate question. The trains affected should not be allowed to pass at speed the whole time the device is out of order. It is recommended, mo-

reover that any electric interlocking out of order should be cancelled by the signalmen and « repeater » devices being used each time the defective equipment is operated.

14. Long-distance point operation, by means of devices with few control circuits and operating circuits gives excellent results and appears likely to be developed considerably, in particular for operating single-track lines with heavy traffic, as it may make it unnecessary to double such lines.

15. Automatic point operation by the trains themselves also gives good results, at least with simple track layouts.

Locomotive cab signalling.

16. It is desirable to facilitate the work of the driver by equipping the engines with signal repeating devices or with continuous signalling; automatic braking can be added with either arrangement.

This equipment is specially desirable on busy lines or lines run over by high-speed trains.

17. Steps should be taken to prevent the driver becoming less vigilant when such equipment is provided.

Signal repetition.

18. Distant signals (warning and speed restriction) in the danger position should be repeated. It is also useful to repeat these signals when off.

19. Cab signalling equipment with purely mechanical transmission of the indications is only suitable for trains running at low speeds.

20. Equipment with electro-mechanical (contact) transmission should preferably give the « danger » indication by cutting off the current.

If, on the contrary, it gives the « danger » indication by emitting current, it must be maintained in very good order.

21. Non-contact devices are definitely better than those working by contact.

Continuous signalling on the locomotive.

22. It is desirable as a rule to retain the permanent-way signals, even when cab signals are fitted on all the locomotives running on the line.

23. There does not appear to be any disadvantage in giving one more indication on the engines than those given by the permanent-way signals (advance warning, for example). This is particularly valuable in the case of a section of line run over by some ultra-fast trains for which the permanent-way signalling has become inadequate.

Comparison.

24. Undoubtedly, from the working point of view, and also to some extent from that of safety, continuous signalling is better than signal repeating, even with non-contact apparatus.

25. Continuous signalling is much more costly than signal repeating, even in the case of non-contact apparatus, when the line is not already equipped with the automatic block. This system, therefore, can only be considered by railways already equipped or to be equipped with the automatic block on a large scale.

The Railways which for some reason

or other are not proposing to install the automatic block on a large scale are rather led to adopt signal repetition preferably by means of non-contact equipment.

Automatic braking.

26. Automatic braking limited to home signals passed at danger raises no difficulty in principle, but is only suitable for lines run over at low speeds.

27. On lines run over at high speeds, the brakes should be applied automatically at the distant signal. The application of the brakes can be independent of the train speeds or depend thereon.

28. Automatic braking independent of the train speed always involves the provision of means by which the driver can cut out the automatic action when he has sighted the signal. In these conditions automatic braking appears to be superior to signal repeating only in the very exceptional case of both driver and fireman being unable to operate the brake.

29. Automatic braking depending on the train speed is more valuable than the former, especially in the case of ultra-high speed trains; it is incontestably of lower value when the engines are equipped with cab signals.

SECTION IV. — General.

QUESTION X :

Effets of the world crisis and road competition on the railway position. Corresponding changes in railway commercial policy,

by Dr. COTTIER,
Special Reporter.

Question X was dealt with in three reports as follows :

Report by Mr. ASHTON DAVIES ⁽¹⁾ (Four main-line Railways of Great Britain — affiliated to the International Railway Union — and main-line Railways of all other countries, not affiliated to the International Railway Union);

Report by Dr. COTTIER and Dr. TRIERENBERG ⁽²⁾ (All main-line Railways affiliated to the International Railway Union [U.I.C.], except the four British main-line Railways);

Report by Messrs. LAVALLE and MELLINI ⁽³⁾ (All secondary Railways).

* *

I. — Economic evolution in recent years.

1. The evolution of general economics.

The world crisis, which started in 1929, reached its worst stage in most countries in 1932-1933. In 1934-1935 there were indications of an economic revival; the latter became more accentuated in 1936, there being more or less pronounced progress in all branches of human activity.

One of the most marked phenomena of the crisis was the great *decline of industrial production*. The latter reached its low water mark in 1932; the slight improvement which took place after that year increased progressively, as is shown by the following index numbers of world industrial production :

December									
1928	1929	1930	1931	1932	1933	1934	1935	1936	1936
100	108	95	85	74	84	92	103	118	129

In several countries, such as those of the sterling group, Germany, U.S.A., Japan and Chili, industrial production exceeded the 1929 level. The revival was somewhat slower in Belgium, Holland, Poland, France and Switzerland.

Among the larger branches of industry

it was the *armament trades* (iron and steel, constructional works, shipbuilding yards, etc.) which expanded most. In order to give an idea of the growth of world expenses on armaments, we give below a series of index numbers published recently by the « Institut für Konjunkturforschung » :

(1) See *Bulletin of the Railway Congress*, February 1937, p. 309.

(2) See *Bulletin of the Railway Congress*, April 1937, p. 1109.

(3) See *Bulletin of the Railway Congress*, May 1937, p. 1209.

Index-numbers of world expenses on armaments :

1928	1929	1930	1931	1932	1933	1934	1935	1936 (*)
100	102	109	102	95	94	107	162	200 to 233

The world *production of raw materials* has evolved since 1928 as follows (not including Russia) :

1928	1929	1932	1933	1934	1935	1936
100	106	65	75	81	90	101

The index number of world production of metals fluctuated as follows :

1928	1929	1932	1933	1934	1935	1936 (*)
100	109	49	61	75	90	109

The industrial activity consequently appears to have increased to a greater extent than the production of raw materials. This fact is partly to be attributed to technical progress which enabled raw materials to be economised and synthetic products to be placed on the market, and partly to a better use of waste materials; it is also due to progressive *use of stocks accumulated* during the crisis years.

Agricultural production, which is less susceptible to crises, did not undergo the same reduction as to quantity. But owing to the unequal quantitative evolution of agricultural production and industrial production, on the one hand, and on the

other hand owing to decreased purchasing power of urban populations, prices of agricultural products fluctuated very considerably, which in turn resulted in decreasing the purchasing power of farmers and the sale of manufactured products for agriculture.

The year 1936 saw a general *rise*, and in some instances a very marked rise of the more important foodstuffs and of most raw materials. The first effect of this progressive rise in prices was a notable increase of the purchasing power of producing countries.

Unemployment has not decreased in latter years in proportion to the increase in industrial production. This fact is explained by technical progress and rationalisation measures which enabled a greater volume of production to be achieved with a smaller number of hands. In order to combat unemployment, many States are carrying out large programmes of constructional and other public utility works.

The development of *world trade* during the last few years is shown by the following figures :

	1929	1931	1932	1933	1934	1935	1936
Value	100	58	39	35	34	34	37
Quantity . . .	100	86	74	76	76	78	81 (*)

The divergence in the evolution of these two series of figures is due to the big drop in prices. In spite of the economic revival which took place in most countries, the international exchange of goods has only increased slightly and about half the increase in value is attributed to the rise in prices, whilst on another hand increased requirements for armaments help to swell the figures for export trade. The economic policy of many countries has been altered radic-

ally in recent years. Restrictions of all kinds, difficulties in transfer, « clearing » agreements, etc., are keeping world trade down more and more and are a serious obstacle to a continuation of world economic expansion.

2. The economic evolution of railways.

If in recent years the position of railways has improved to a certain extent, they have not as a whole benefited by the economic revival to the same extent as industrial production. The exchange of goods between States, which, apart

(*) Estimated.

from ocean and inland navigation is mainly handled by railways, has suffered to an appreciable extent from *efforts towards autarchy* made in many countries. As long as international trade is strangled by barriers opposing imports, clearing systems, etc., the railways can have little hope that their traffic will regain its pre-crisis figures. Again, the uncertainty of monetary conditions opposes a normal development of commercial relations and is a serious obstacle to an economic revival of railways.

The three reports give details as to the evolution of traffic and receipts of the different Railways; we refer readers to the figures shown in these tables.

On most railway systems goods traffic has shown itself, in the evolution which has taken place during the last few years, to be more sensitive to economic fluctuations than passenger traffic. The heavy fall of world trade prices has, in general, also exerted pressure on transport rates. As a result of this, competition from road motor vehicles, with its constant cutting of rates, has been favoured to an exceptional extent. During the crisis, railway receipts in most instances declined more than the tonnage carried. On another hand, the economic revival of the last few years has had the consequence of increasing tonnages more than receipts. The final result is a continuous fall of the net product of railway operation.

We find the same evolution in passenger traffic. Whereas, in this case, the crisis commenced to make its effects felt later and did not cause such a large proportion of shrinkage as in goods traffic, the average product per passenger-mile has fallen constantly in recent years.

Since the end of the crisis, there are practically no railways who have succeeded in raising their receipts in proportion to the quantitative traffic.

Any traffic regression first of all entails for the railways a poorer utilisation of their fixed plant and rolling stock, which it is seldom possible to make good

by a corresponding reduction in expenses. Consequently, on all railways the ratio of operating receipts to operating expenses has declined during the crisis years; operating receipts in many cases were not even sufficient to cover operating expenses. In numerous countries it has been necessary for the State to bear railway deficits; when the crisis was in its worst stage, the necessary subsidies amounted in many instances to very considerable sums.

Since 1933 the situation has improved in an ever greater number of countries. When an increase in traffic entailed an increase in operating expenses, the latter however remained below the increase in receipts. Owing to this fact, certain railways were able to put an end to their deficits, whilst others witnessed increased surpluses or obtained a more favourable operating coefficient. Generally speaking, however, their financial position as a whole is still far from having reached the excellent 1929 level, and in a whole series of countries the railways will still be obliged to have recourse to State subsidies.

Whereas in 1936 the tendency towards a revival increased in the case of the majority of railways, railway traffic was still declining in countries which remained longest on the gold standard (i.e. France, Holland and Switzerland). This state of affairs persisted until the latter countries devalORIZED their currencies at the end of September last. Since that date the general improvement of economic circumstances also made itself felt there and the traffic of their railways has in some instances considerably increased.

II. — New trend of the transport policy.

1. The development of road motor competition and its effects upon the economic situation of railways.

The following table shows the development of the world fleets of motor vehicles since 1925 :

Number of automobiles throughout the world

(in thousands)

31st December.	Private vehicles.	Public vehicles.		Total.
		Motor buses.	Lorries.	
1925.	20 965	159	3 440	24 565
1929.	29 367	242	5 280	34 877
1930.	29 767	328	5 509	35 603
1931.	29 083	358	5 617	35 058
1932.	27 792	394	5 447	33 603
1933.	27 558	347	5 395	33 331
1934.	28 881	370	5 837	35 088
1935.	30 537	385	6 314	37 236
Increase 1925 to 1935 .	46 %	142 %	84 %	52 %

During the 1925-1935 period the number of public vehicles increased more rapidly than that of private vehicles. In 1932 and 1933, in which the crisis reached its culminating point, the number of motor vehicles decreased slightly, this

decrease being noticeable more particularly in the case of private vehicles than in that of public vehicles.

The *world output* of automobiles in recent years was as follows :

Year	1928	1929	1932	1933	1934	1935	1936
Thousands . . .	5204	6278	1977	2757	3756	5127	5850
Index	83	100	31	44	60	82	94

After the low-water mark in 1932 the annual output of motor vehicles increased steadily. In 1936 it again passed the 1928 mark and approaches that of 1929. In view of this increase in the output of motor vehicles it can be reckoned that the world's fleet of motor vehicles amounted in 1936 to 40.5 millions.

If, in a few countries, the crisis had the effect of temporarily reducing the number of motor vehicles, the opposite tendency recently showed itself to a marked extent. It is all the more pronounced because the average number of motorists per 100 inhabitants has remained lower hitherto. In no country is there so far any indication that the stock of automobiles has reached the saturation point.

The harmful effects of road motor competition upon railways are undeniable, although the differences from one country to another are fairly pronounced, according to the nature of the economic,

geographical and demographical circumstances, the density of rail and road networks, and the average transport distances by rail. Nearly all the railways who replied to the questionnaire state that the desertion of railway traffic to the road has not yet reached its climax and that motor vehicle competition becomes ever keener.

(a) *Passenger traffic.*

In all countries competition from *private automobiles* has caused railway passengers previously travelling in the higher classes to desert the railways. Tariff measures and improvements in the railway services have, in general, only succeeded in bringing back passengers travelling in the lower classes.

The purchasing power increasing as trade revives, the effect in all countries will be an increase in the number of

private automobiles. The railways will have to accomodate themselves to this growing competition; legal enactments for restricting the latter are not being forthcoming anywhere. On the contrary, in a few countries fiscal advantages granted to private automobiles are all in favour of motorisation.

As regards *professional passenger carriers*, considerable distinctions are made in the various countries between *regular lines* and *occasional services*. Competition by regular road motor lines is being more and more hampered by legislative measures consisting in either preventing their excessive multiplication by enforcing obligatory licences, or by refusing any licences on routes competing with existing railways. In some countries a right of priority has been given to railways for competitive routes.

Road carriers are usually much freer to organize occasional runs. As their fares for the latter are generally lower than the railway rates, and they are not tied to any timetable and can to a large extent meet the wishes of the public as regards routes, they are everywhere in great favour. In recent years the number of countries who make occasional transport also subject to a licence is on the increase, although there are usually less restrictions than for regular motor lines.

Professional road transport fares show everywhere a *tendency to decrease*, unless they have been fixed by regulations. The cars used for such journeys are constantly growing larger and more comfortable, whilst in the case of private automobiles, the small, light and economical car is being more extensively bought. In both cases the evolution is towards an economic improvement of automobile services.

As regards professional passenger road transport, a tendency is noticed in some countries to set up larger and larger undertakings. In the U.S.A., for instance, amalgamations, participations and purchases of shares have brought large concerns into existence, the situation of

some of these, from the standpoint of capital invested, being very complicated. Their routes extend all over the Continent.

(b) *Goods traffic.*

In the case of goods traffic, the great majority of motor vehicles are used for private transport. Their radius of action is usually restricted to neighbouring zones. In no countries is there any extensive purely private transport to distances over 100 km. (62 miles). On the contrary, *professional* carriers mostly carry out long-distance transport. In addition, vehicles used on such service preferably have a large carrying capacity. The result is that, as regards competition with railways, it is above all professional road transport which is most severe from the standpoint of ton-mileage.

The economic value of such vehicles has constantly increased in recent years. Thus the number of heavy vehicles, notably those driven by diesel engines, is increasing. The ratio of the tare weight to the paying load has constantly changed in favour of the latter, with the result that from a competitive standpoint, the efficiency of the vehicles has increased to a larger extent than their numbers.

The cost of transport by lorry, on the one hand, and the taxes levied on professional goods transport, on the other hand, are constantly on the downward grade. Among professional goods carriers the *small undertaking* predominates. When amalgamations have taken place, they have not been carried out in any systematic manner.

The world crisis caused in all countries an extraordinary intensification of competition for goods traffic. Frenzied rivalry in the lowering of rates brought about a profound disorganization of the transport industry. Wages and working conditions of motor drivers have fallen to a very low level. This state of affairs was aggravated by the fact that numerous lorries belonging to private owners, and which could not be sufficiently em-

ployed, began to be used accessorially for the professional carriage of goods (irregular private traffic) and thus helped to lower rates.

Speaking generally, the public authorities did not decide to repress disorderly competition for goods traffic by legislative means until the time arrived when the latter were also demanded by private carriers. Most of the regulations issued in recent years only regulate professional transport and usually restrict irregular private traffic. As a rule, simple *administrative regulations* were issued making licences obligatory for professional transportation and for the purpose of preventing unfair competition. In a few countries attempts were also made to solve the rail and road problem, by laying down limits within which lorry transport could be worked, or by promoting collaboration between these undertakings and the railways. In some instances, also, attempts to increase the taxes on private traffic were met with, but nowhere has the principle of freedom of action been abolished.

In many instances, these legal regulations have helped to strengthen the position of road motor transport; everywhere the latter has sought to improve its organization and, by creating joint goods distribution centres (such as the Road Clearing Houses in Great Britain), to also make parcels transport remunerative. In all countries private traffic is gaining ground in the neighbouring zones, whilst professional traffic, unless restricted by legislation, is extending its sphere of action to ever longer distances, using more powerful and more economical vehicles and constantly lowering its rates.

2. Principles of the transport policy.

The critical situation in which rail and road transport undertakings found themselves during the crisis had the effect of turning the battle between rail and road into a *public problem* in all

countries. Everywhere, people became convinced that the difficulties met with by the transport industry could only partly be considered as the effect of the universal economic crisis. Now, legislative steps taken in recent years by many countries have as a rule not gone beyond the experimental stage. This uncertainty must above all be attributed to the fact that hitherto leading economic circles, and sometimes also Governments, have taken much too little heed of the nature and scope of the problems to be solved. In too many instances the action is based on the mistaken conception that the *technical and economic merits* of the two methods of transport are the decisive factors, whereas the real causes of the conflict lie elsewhere. In all countries railways are subjected to a rigorous State control, whereas the motor transport industry has freely developed. *Owing to this fact, the mutual action of of the technical and economical factors has been distorted and the evolution has not been allowed to follow its natural course.*

(A) Reasons for State intervention in transport services.

In a very few countries has railway legislation been restricted to enactments that would have sufficed to protect the public against the power of large railway companies; usually, the State placed railways at the service of its own political aims. They were thus *invested with a public function*; the quality of *public services* was conferred on them. As a rule, this evolution was most completely accomplished in countries in which the State, by buying out the railways, itself took in hand the working of public transport. But in other countries also, where the railway operation was left in the hands of private undertakings, the latter were called upon to a greater or lesser extent to fulfil certain obligations towards the State.

The aim of this intervention, based on

political reasons, of the public authorities in the operation of railways was to ensure, by an appropriate organization of the service, as uniform a development as possible of all parts of the population and of the country. In order to enable manufacturers and craftsmen of all kinds to establish themselves in the countryside, it is necessary to offer them — from the standpoint of regularity, safety in operation and cheapness — means of transport that are practically the same as in more or less important economic centres. Many secondary lines, which have to be operated at the same rates and under the same service conditions as those ruling on main lines carrying heavy traffic, thus form to-day a heavy financial burden upon railways. In order to offer the requisite guarantees of safety, it is necessary for the public service to be able to function with invariable regularity and to meet at any moment all demands for transportation (obligation to operate and carry). This obligation necessitates operating installations and means capable of coping with all traffic peaks that may arise. But the consequence is bad utilisation of the means of action, and thus in this respect also the railways are economically burdened in their quality of public carriers.

The collective economic character of railways also extends to their rates. *Rates based on values* efficaciously help the State in its efforts towards decentralisation of its economic life. It facilitates the carrying of raw materials and bulk goods of low value and, by the higher rates applied to finished products, it acts as a protective tax for industries situated away from the places of extraction and delivery of raw materials. In this manner the framing of railway tariffs was subordinated to a large extent to the aims of the State's political economy. Obviously a tariff drawn up on these bases ought to be *constant and sure*; frequent changes, dictated by the financial position of railways, were not permissible.

On another hand, it was found necessary that railways should also shoulder the necessary expenses to meet the requirements of the military authorities. The labour conditions governing public transport undertakings were not able to free themselves from the influence of the State's social policy. In the interests of *safety of the service*, working hours were subjected to particularly strict regulations.

All the obligations which we have just briefly enumerated were imposed upon railways in their capacity of public carriers; they result in a fairly heavy financial burden.

(B) The influence of motor transport on the official transport policy.

Railways lent themselves particularly well to furthering a transport policy that safeguarded public interests, because they are large undertakings easily controllable and because the *public nature* and *regularity* of working of their services are already inherent in their technical nature. *Railway services are, by their very nature, public services.*

Automobiles provide an efficient means of transport, the technical nature of which has permitted the creation of a considerable *individual traffic*. Two important problems are thus set, the solution of which represents the programme of future transport policy :

(a) How can the new means of transport be co-ordinated with the existing system of public transport services ?

(b) How are the relations between private traffic, of recent creation, and public traffic to be regulated ?

(a) *Co-ordination of the means of transport performing a public service.*

The reply to the first question is comparatively simple. By their technical and economic structure, automobiles are suitable for individual transport, but that by no means prevents them from being

used on a public service. Railways were not backward in realizing that if road motor vehicles are awkward competitors, their technical qualities allow them to be usefully employed to implement rail transport. They thus found themselves faced with two sorts of solution :

a) Passenger traffic :

1. Creating new transport lines in order to connect with the railway system such regions as are devoid of railways.

2. Replacing passenger trains by motor vehicle services, either with a view to relieving certain sections of railway line and providing closer timetables, or discontinuing an unproductive passenger train service on entire lines or at small intermediate stations.

3. Organisation by the railway of occasional runs, either in the shape of pure road transport, or in conjunction with the railway service, as a protection against competition of private undertakings.

(b) Goods traffic :

1. Creation of official railway cartage services, in order to provide door-to-door transport;

2. Extension of cartage services, in order to link up districts having no railways, with the railway network;

3. Transfer to the road of short-distance traffic between traffic centres and small intermediate stations, with elimination of slow goods services of secondary importance, either parcels services alone, or all goods;

4. Carrying out transport on request by means of road vehicles, as a means of protection against competition from private undertakings.

Recourse has been had to these solutions either by setting up automobile services belonging to the railway, or affiliated undertakings, or by making contracts with private carriers. The first method mainly consisted in organizing road

services implementing the railway services. Replacing a railway service by a bus service was generally only done when a saving could be effected thereby. The method least adopted at present is the railways working occasional and specially requested road transport. This measure has, however, been adopted with good results in special cases by certain secondary railways which have thus become important transport undertakings in the district they serve.

When motor vehicles are used to replace a train, the railway tariff is usually applied, whereas feeder services to the railway are generally operated on the simpler automobile rates. These latter services often do not pay their way; but owing to their utility as a means of protection against competition and as a feeder, the granting of subsidies is considered justifiable and advisable.

A form of less close co-ordination of road transport with the railway services exists in Great Britain and the U.S.A., consisting in the railways participating financially in the road transport undertakings in order to control the latter to some extent. The object of this is to establish some co-ordination, not very close, it is true.

Co-ordination of motor transport with other public transport services is specially effective when based on *legislative measures*. These measures were taken in the first instance, and in the most complete manner, for passenger traffic for which in most countries the operator of a regular line must obtain a licence. If concessions are not granted for runs competing with existing railway lines or if the railways have a priority right on such runs, co-ordination between the two means of transport is complete. It is more difficult to create co-ordination in the matter of occasional runs for which *obligatory concessions* are being more and more imposed.

The most complete co-ordination between public rail and road transport

exists when there is a *monopoly* for all professional transport. Perfect organisation of this kind is witnessed in the « London Passenger Transport Board » which has united in the hands of one single authority all the means of public transport in the city of London. This Board has founded, in conjunction with the four main-line Railways, a pool into which are paid the receipts from all suburban traffic.

Co-ordination of the public goods transport services encounters greater difficulties. Professional transport of goods is most often carried out in the form of occasional traffic and consequently means a private individual service. Its co-ordination with a public transport service is usually not successful, except in the form of a legal monopoly. This method was adopted in Hungary and in Ireland where the professional carriage of goods was made subject to obligatory concessions and placed in the hand of the railways, who connect it to the rail service in the nearest zone.

(b) *Relations between public traffic and private traffic.*

If co-ordination between railways and road transport, considered as public services, constitutes, according to what is explained above, a comparatively simple problem which has been solved to a large extent in most countries, a general determination of the relations between rail and road, from the standpoint of political economy, encounters much greater difficulties. As automobiles have provided the means of ensuring an important individual service, the system of public transport carried out by two methods, — rail and motor vehicles — is faced with private traffic which, whilst being exonerated from the heavy taxes levied on a regular service — which is safe and is operated on collective principles —, selects at its own free will its traffic and only operates when such traffic is remunerative. Transport can be oper-

ated professionally or by industrial undertakings for their own use. In both instances it only has to take into account considerations of convenience for the undertaking which uses it, and is not called upon to fulfil any task that does not give it a profit. The end of this unequal fight is easy to foretell. Only functioning when a sufficient load or profit is guaranteed, private motor vehicles are bound to accapare all traffic which would also have yielded a profit to public transport undertakings and formed some financial compensation for the numerous unproductive tasks imposed upon these undertakings. Consequently, in the long run, public transport undertakings will be all the less capable of carrying out, by their own means, tasks which have to be fulfilled in the general interests of the public, that private carrying concerns operating only on the principle of a lucrative service will function under ever more and more economical circumstances, thanks to technical progress and the improvement of their organisation.

Theoretically, there are two solutions to this dilemma :

1. The State liberates public transport undertakings from all tasks which they are no longer able to perform by their own means and gives up the idea of subjecting public transport to the furtherance of its own interests.

2. The State contents itself with organizing a public transport service which should guarantee a uniform development of all parts of the country and which it could place at the service of its political interests. In this case it must create sound bases on which public transport undertakings may subsist alongside private competition.

In actual practice, the former solution will not be workable in the many countries whose economic, geographical and demographic circumstances have developed with the aid of a collective economic transport service. The interests indissolubly connected with the public transport

services are so many and so important that the idea of abandoning them cannot be entertained. Therefore, in such countries any appreciable alleviation of railway legislation has been deemed impossible. On the other hand, it is conceivable that the development of new countries should proceed under a regime of private traffic unhampered by any State intervention.

In the other countries the question arises as to how public transport ought to be safeguarded when faced with competition from private traffic. This object can be attained either by an appropriate restriction of private traffic or by the State granting subsidies to transport undertakings operating important public services. The latter system is employed in many countries in which the State has, on principle, to make good the deficits of large railways.

But in proportion as private road traffic expands, the Treasury will be burdened with a load which will finally become excessive, with the result that the State will then, in any way, be bound to restrict competition. In many cases, States have hitherto been satisfied with drawing up special legislation aiming at subjecting professional motor traffic to the obligation of obtaining a licence, and thus rendering unfair competition impossible. This step alone will hardly suffice in the long run, as when the time arrives when all licensed contractors, whom these regulations do not oblige to fulfil tasks of collective interest and who are able, as in the past, to freely select their transport, reach their maximum production, then the necessity for granting new concessions will make itself felt and competition will become still keener.

As the technical advantages which motor vehicles possess make themselves felt above all in the case of short-distance traffic and as, on another hand, long-distance traffic creates a source of revenue to railways, efforts are being more and more made to provide efficacious protection for railways, at any rate for

long-distance transport. Consequently, in some countries professional road motor transport has been subjected to a concession system imposing upon the holders a *restricted field of action as regards territory*.

Another possible solution which has been tried out, such as in France, although it has not been definitely applied there so far, consists in *regional apportionment of traffic*, which has to be effected by means of agreements under a system of concession regulations. Short-distance traffic was to be reserved on principle for road carriers and long-distance traffic for the railways. But the proposed abandonment of rail service in certain districts aroused practical difficulties, the populations concerned not being disposed to willingly accept the less satisfactory service conditions which would result therefrom.

An organic incorporation of motor transport in the collective economic railway traffic and tariff system, without restrictions as regards territory and without creating a monopoly, encounters serious difficulties because real control of the many independent undertakings is a far from easy task. In Germany a system of licences for long-distance traffic was inaugurated (short-distance traffic not being regulated), which unites the licensed contractors into a central professional association and obliges them to apply rates similar to those of the railways. In spite of a rigid organisation, the control of tariffs has proved difficult.

In order to solve the problem, Germany and Italy have had recourse to fiscal measures. Together with an all-round raising of railway rates, they introduced taxation of motor transport on a ton-kilometre basis, which affects professional carriers as well as private industrial traffic.

The aforementioned legislative measures only concern professional traffic, whereas, except in Czechoslovakia in the form of an increased tax, private traffic

has not hitherto been restricted. Only the future will prove whether this freedom can be conciliated in the long run with the maintenance of a collective economic transport service.

The great importance which is attached to maintaining the economic mission of public transport undertakings is clearly shown by the following statement of the Swiss Government, which appears in the message issued by the Federal Council on November 21st, 1936, concerning the improvement of the position of the Swiss Federal Railways :

« The solution of the rail/road problem » is the indispensable initial condition » to a lasting reform of the Federal Railways, » ways, and as long as nothing definite » has been done in this respect, all the » rest is bound to remain temporary and » doubtful... The regulation of transport, » which it is thought to bring about, » must notably guarantee to the railways » an equitable share of future traffic, » proportional to the general part they » have to play in national economics » and to the amount of capital invested » in this industry. »

(C) Repercussions on transport economics.

The effect of the growing road-motor traffic upon transport economics in States which will not or cannot abandon the performance of public transport in accordance with collective methods, nor restrict individual motor traffic to a sufficient extent, consists above all in the State having to make good the unavoidable deficits of the railways by means of the general Treasury resources after having exhausted the possibilities of rationalising railway services (among which we also see, in certain circumstances, the use of motor vehicles).

On the other hand, motor transport economics will in the future, more than hitherto, feel the influence of the general transport policy. An indirect protection of railways can be achieved by a rigorous

application of police regulations to road transport. So far, this means has not been made use of. Regulations concerning the maximum dimensions, maximum weight and maximum speed of motor vehicles have not gone further than being a means of preserving the roads to some extent. Far from being excessive, one rather has the impression that these regulations, and *above all the control of their observance*, would be much more rigorous in many countries if the whole transport economy, comprising all routes employed, were governed by uniform rules. That is also urgently desirable in the interest of safety — which is not precisely exemplary — of road traffic which is much inferior in this respect to the service provided by the railways.

Similar considerations apply to the *taxation* of motor transport. It differs much from one country to another. Besides fixed annual taxes which are levied according to the dimensions of vehicles, their weight or the power of their engine, there are taxes on fuel and on rubber tyres. These taxes are partly of a general fiscal nature, but attempts are constantly being made to bring them more into line with the actual wear and tear of roads. Nevertheless, there is in no country any precise relation between taxation of motor vehicles and expenses on roads; as a rule, the latter cannot be determined in any exact manner, seeing that they are split up between the budgets of the States, provinces and parishes. In a few recent instances taxes have also been levied *to serve the purposes of the transport policy* (Germany, Italy, Czechoslovakia). Speaking generally, for this purpose there ought to be applied a tax calculated on the basis of effective distances actually run (passenger-mileage or ton-mileage). On principle, taxes of this kind ought to be considered as a means for compensating the exoneration of private automobile traffic from the burdens imposed upon public services.

3. Determinative factors of sundry kinds.

The solution of the rail/road problem is also rendered difficult by the intervention of factors having nothing to do with the transport policy, and in the forefront of which we see *considerations of national defence*. The motorisation of modern armies requires a considerable fleet of motor vehicles, the latter having expanded all the more because railway installations have become more vulnerable to air raids on a large scale. One often hears the erroneous opinion expressed that the State can obtain the requisite number of motor lorries, without spending any moneys, by furthering the multiplication of private vehicles thanks to lightened taxes. The partisans of this theory forget the effect which such competition, brought about artificially, would have on the railways. If the latter are no longer able to carry out by their own means the public duties with which they are invested, the State usually has to grant them subsidies, without taking into account the fact that railways are still themselves an important factor of national defence which it is absolutely necessary to maintain for military reasons.

When a State finds itself faced with the necessity of making good deficits of railways caused by motorisation brought about by military requirements, it appears advisable to look into the question as to whether it is not preferable to entrust to motor vehicles part of the railway services, even if there is additional expense entailed. If this policy were adopted there would be a certainty of having at all times available vehicles in a good state of repair, that could be used for military purposes.

To make our enquiry complete, we would mention one or two other factors not akin to transport policy and which form an obstacle to solving the rail/road problem. In certain quarters, there is a tendency to consider motor transport as

an efficacious means of restricting, to the extent which economic authorities consider advisable, the social combativeness of the influential railway workers' unions. On another hand, the existence of independent undertakings in the transport industry is considered as a social progress, the development of which it is undesirable to hamper.

Finally, we would mention that in many countries the policy adopted for fighting unemployment favours the development of motor traffic by carrying out large road-building schemes. However, the improvement of the railway system is also an excellent means for giving employment, but this resource has often been neglected.

4. The necessity for statistical bases.

The enforcement of legislative measures tending to solve the transport problem is made extremely difficult by the fact that in most countries the authorities have to be satisfied with estimating the nature, composition and extent of road transport. The result of any attempt made for the purpose of a final settlement of the relations between rail and road will be uncertain as long as it will be impossible to foretell their effects with the help of an exact knowledge of all the data concerning the various kinds of traffic. It is therefore eminently desirable that the resolution passed by the VIIIth Congress of the International Chamber of Commerce in 1935 (Paris) should be taken into consideration by the public authorities.

III. — Adaptation of the commercial management of railways to present circumstances.

1. Changes in the organisation of railways.

The regression of receipts caused by the crisis and competition from road motor vehicles obliged all railways to organise their services on the most economi-

cal lines. Since 1929 a considerable amount of rationalisation work has been accomplished everywhere, resulting in an all-round improvement of the efficiency of transport by rail. If expenses have again increased in recent years, their increase has usually been less than that of transport and than the surpluses of receipts. In the United States, and recently in France also, social legislation has burdened railways with fresh charges.

In a few countries economic progress has also been made as the result of closer collaboration between the various railway systems. In the United States the rationalisation programme of the former Co-ordinator of transportation continues to be applied by the railways; and the joint use of certain installations by several companies, and amalgamations, have made it possible to effect appreciable economies.

The British railways have centralised receipts of their competitive companies in joint pools; thus, where there was formerly competition there is now reciprocal collaboration. Faced with increasing road competition, the adoption of a measure of the same kind will become imperative in the near future for *international competitive lines*.

Several railways have adapted their organisation to the new economic circumstances and to the situation now created by competition, by separating the commercial department from the technical operating department or by allotting to it, within the sphere of the latter, an independent task. In this respect we ought to mention the example of the London Midland and Scottish Railway which has united all the commercial and propaganda service in one single well organized management: the latter decides as to the guiding lines which appear advisable to it for publicity purposes, although the application of same is incumbent upon the technical departments.

2. Publicity services.

The tendency for railways to establish closer contact with their clients is expressed in a tangible form in their organization of the advertising department. For goods traffic many Administrations have appointed special agents who frequently call on consignors and explain to them the advantages of rail transport, and ascertain any special wishes.

For passenger traffic the advertising department has in many countries been established on a national basis. Semi-official or official organisations, which usually have agencies abroad, co-operate with the railways and the public authorities. Their work generally extends to all branches of tourism and all kinds of available methods of transport.

The expenses of railway companies for publicity purposes have on the whole increased in the last years, although they remain moderate when compared to the total operating expenses. Certain railways award to their publicity staff premiums for any particularly good results achieved.

3. Improvement of services.

a) *Passenger services.* — Motor vehicle competition has decided most railways during the last few years to make considerable improvements to their passenger services. In all categories of trains comfort has been increased by a better fitting out of the carriages. In many instances third-class coaches are now upholstered. In the United States the equipping of coaches with a complete air-conditioning plant (heating or refrigeration, filtering) has made great strides. The introduction of one single class has generally not proved to be advantageous, except on secondary lines and railcars.

A very efficacious means of meeting motor vehicle competition has been the *improvement of timetables*. Commer-

cial speeds have been raised all round, both by faster running and by reducing the time taken for stops. In addition, most of the railways have bettered their timetables by running additional trains.

In order to allow these measures to be introduced and nevertheless keep expenses within workable limits, various alterations to the services have been necessary. The time taken for stops of passenger trains could only be shortened by freeing, on principle, trains from all accessory tasks (carrying mails, parcels, milk, animals and so forth). On long-distance traffic the services were accelerated by creating special trains which run non-stop between important places. In some cases new rolling stock has also been put into service. The use of railcars has as a rule helped to increase speeds and lower traction costs. These vehicles have everywhere given proof of their ability to increase train frequency on main lines and secondary lines; they have also given excellent results for passengers travelling in parties. For fast long-distance services new and improved types of vehicles have been built, some of which run at particularly high speeds. In this instance, as satisfactory results have been obtained from steam traction as from diesel engines and electric traction. Streamlining of trains has reduced air resistance.

Several Railways also mention *electrification* as a particularly efficacious means against passengers deserting the railways.

(b) *Goods services.* — Again, in goods services the tendency has shown itself to accelerate transport. For this purpose certain railways have introduced particularly fast-running goods trains. Sometimes a tendency has also been noted to utilise passenger trains to a greater extent for carrying goods, although it is true that this forms an obstacle to the acceleration of passenger trains. Another efficient means of accelerating the ser-

vice has been found to consist in prolonging the time allowed for acceptance and delivery of goods.

A few Administrations have particularly accelerated transport. In France there has been created for all parcels weighing less than 50 kgr. (110 lb.) a single-speed traffic resembling that of fast goods services. The British Railways have introduced a scheme of « registered » transits. The scheme is two-fold, comprising the « Green Arrow » service for freight train traffic and the « Blue Arrow » service for merchandise by passenger train. In each case, in addition to normal charges, a registration fee is levied, and special labels bearing a green or blue arrow are provided for distinguishing the consignment, the invoice, and the wagon in which loaded. Special attention is devoted to these consignments to prevent delays at any point.

Most railways have also attempted to offer the same advantages as motor lorries by the creation of *door-to-door* service. When, for this service, they do not use vehicles which belong to them, they make agreements with motor carriers (sometimes also with agents of all kinds). The charges for collection and delivery have been revised all round and considerably lowered. Many railways grant important *subsidies* for cartage services. These subsidies are amply justified by the fact that they enable cartage rates to be lowered and because this defensive measure against competition is often more advantageous than lowering the rates for rail transport. It helps to widen the clientele of the official railway cartage contractor which is thus enabled to organize his service more rationally, whilst clients become accustomed to the railway door-to-door service. In Holland, and also recently throughout the United States, parcels rates on principle include delivery to domicile.

Attempts are also being made to de-

velop door-to-door service by means of *containers*, the use of which is already widespread, especially in Great Britain, the U.S.A. and Germany. The British railways have succeeded, by using containers, in regaining the greater part of the transport of furniture (removals) which road services had taken away from them.

Containers of a special design have been constructed for carrying liquids. A few railway managements have also put into service vehicles capable of transporting railway wagons by road.

4. Tariff measures.

Although tariff measures adopted by railways are extremely varied in their details, the principle is the same almost everywhere. Both as regards passenger services and goods services, the railways are trying to meet automobile competition by isolated steps. An attempt is generally made to avoid a general lowering of rates, which has the drawback that it affects the yield from non-competitive traffic.

On *passenger services*, the general custom is to grant a host of special reductions for given days, certain runs, excursions to popular places and for parties of all kinds. Only the U.S.A. railways have been obliged by order of the higher authorities to make an all-round reduction of their passenger rates. As this step was taken precisely at the moment when the economic revival occurred, it did not entail any falling off in receipts; the latter, on the contrary, were higher in 1936.

As regards *goods services*, there was a certain relaxation of the rating regulations in most countries, i.e. the railways are allowed to grant rebates on a quantitative basis to big clients who undertake to use the railway. But these authorisations are usually subject to certain conditions and restrictions which may not be infringed. Complete freedom to

draw up tariffs has nowhere been granted to railways. We might mention the case of the U.S.A., where published and stable transport rates are considered an essential condition towards a good economic development, with the result that the obligation imposed upon railways of publishing their tariffs has also been extended to professional road carriers. Nevertheless, the public authorities only intervene actively in tariff matters in exceptional cases. Any transport undertaking can adjust its rates to the circumstances ruling as regards competition, provided they are announced publicly beforehand, that they are granted under the same circumstances to all consignors and that they are not flagrantly cut below operating cost.

A certain contrast to this liberal solution of the question of rates is supplied by Germany, where the system of railway tarification, established under the influence of the State and safeguarding general public interests, has also been extended to road motor transport; competitive tariffs are not allowed either for road traffic or railway traffic. If, theoretically, this organisation created as part of a general economic policy represents the ideal solution, its application is extremely difficult as regards road transport.

As to the other countries, as long as a solution has not been found which guarantees adherence by motor transport contractors to the rates, the railways will be forced to have recourse to competitive rates, for the application of which it is advisable to adopt the stipulation in force in Austria, viz. that certain exceptional rates for raw and auxiliary materials are only granted to users who also hand to the railways their finished products, which are classed in a higher category of the tariff.

5. Participation of railways in road transport.

Most railways are interested in some

manner or other in road transport, either by means of vehicles belonging to them or by a financial participation or, as frequently occurs in accessory railway services, by employing contractors. The possibilities of using road motor vehicles to replace a rail service are comparatively restricted, owing to the fact that there are relatively few instances in which a contractor who undertakes all the obligations incumbent upon railways can make any appreciable profit. When participating in road transport, the aim of railways is usually to extend their field of action and especially to meet automobile competition by door-to-door transport. *The more it will be possible henceforth to incorporate motor vehicles in the public transport system of a country and to protect the latter against competition by private undertakings, the closer will organic relations between rail and road become, and the more will the active participation of railways in motor transport extend.*

IV. — Summary.

1. After the world economic crisis had reached its culminating point in 1932-33, tendencies towards a revival of business revealed themselves in a growing number of countries. Under their stimulus, railway traffic also increased somewhat, although to a smaller extent than the development of industrial production. The exchange of merchandise between States is hampered by import restrictions, clearing systems, currency restrictions and monetary instability, with the result that the financial position of railways is slow in improving in most countries. In the interests of a return to a sound economic position of the transport industry it is desirable that these artificial barriers to international trade be lowered, and as far as possible, abolished.

2. In all countries the number of motor vehicles is increasing. The efficiency of road motor transport is constantly

improving as a result of technical progress and railways are subjected to ever keener competition from road motor vehicles.

3. There is often the mistaken belief that in the fight between rail and road, the technical and economic efficiency of the methods of transport are the decisive factor. Railways in most countries are bound by law to carry out public transport according to principles safeguarding the public interests. It is necessary that transport undertakings charged with essential public functions be protected against competition from private transport undertakings which are under no obligation towards the public, and are free to select their traffic. With the aid of appropriate measures, care should be taken that long-distance traffic be mainly handled by the railways, which should retain their mission of economic protection of the community.

4. By means of participation of the railways in road motor transport, endeavours should be made to bring about as complete a co-ordination as possible of the two methods of transport in public services.

5. The necessities of national defence should be met by creating a sufficient fleet of motor vehicles suitable for military purposes, whilst avoiding as far as possible any excessive and uneconomic increase in the means of transport as a whole.

6. In order to avoid unfair competition and obtain safer road traffic, the authorities concerned should enforce a stricter compliance with police regulations by road motor vehicles.

7. Railway publicity departments should seek as close a contact as possible with patrons. The greatest attention should be paid to a knowledge of the wishes and requirements of the latter.

8. Improvement of timetables and acceleration of trains on passenger services have proved to be efficacious means of meeting competition. On goods services, equally, the maximum acceleration is advisable, as also the extension of door-to-door services.

9. The framing of a regular system of tariffs should be considered as an important object of any transport organisation fulfilling the requirements of the national economy. For this purpose, the successive and reciprocal lowering of

rates should be forbidden when brought about by competition between various methods of transport.

The application of this measure is difficult in the case of road transport. Railways in most countries are still obliged at present to have recourse to tariff measures as a means of protection. Isolated rate reductions to meet given cases have usually given better results than a general lowering of tariffs. It is advisable to subordinate the granting of reduced rates to a fidelity clause.

QUESTION XI.

Selection, orientation and instruction of railway staff,

by J. WOJCIECHOWSKI,

Special Reporter.

CONTENTS :

- I. Foreword.
- II. General statement.
- III. Conclusions.
- IV. Summary.

* * *

I. — Foreword.

The object of the present statement is to sum up the three reports submitted on this question :

(1) Report by Mr. P. LO BALBO ⁽¹⁾ (Italy, Spain, Portugal and Colonies, Great Britain, Dominions and Colonies, North and South America, China, Japan, Egypt);

(2) Report by Mr. J. HONDL ⁽²⁾ (Czechoslovakia, France and Colonies, Belgium and Colony, Luxemburg, Switzerland, Austria, Hungary, Jugoslavia, Bulgaria, Rumania, Greece, Turkey);

(3) Report by Mr. J. WOJCIECHOWSKI ⁽³⁾ (Poland, Germany, Netherlands and Colonies, Denmark, Norway, Sweden and Finland).

In the general statement the particular subjects are dealt with in the order they were included in the questionnaire sent out to the member Administrations.

(1) See *Bulletin of the Railway Congress*, December 1936, p. 1549/1.

(2) See *Bulletin of the Railway Congress*, February 1937, p. 443/23.

(3) See *Bulletin of the Railway Congress*, December 1936, p. 1559/11.

II. — General statement.

A problem of great and present-day interest from the standpoint of the human factor is that of selection, orientation and instruction of railway staff.

The outlay for this staff amounts on an average to 60 % of the total operating expenses : therefore, if this percentage were only slightly lowered, considerable savings would be effected as a result. If in the past savings on staff expenses have been chiefly obtained by cuts in wages, at present it appears preferable to achieve this object by increasing the efficiency of the staff, which is the aim of the education, selection, and professional guidance of railway staff.

This question has already been placed several times on the agenda of the Sessions of the International Railway Congress Association, viz :

1. At the Milan Congress (1887) under the heading : « Organizing, appointing and training staff »;

2. At the Paris Congress (1900) : « Technical education of railway servants. Appointment and promotion », with the following sub-title : « Attempts made by the railway administrations to promote the technical education of their staff ».

3. At the Madrid Session (1930) : « Methods to be followed in the training of staff : professional, technical and ordinary working grades ».

At this latter session several Reporters stressed the utility of a psychotechnical examination when recruiting staff for the Operating Department.

To-day we note that in European countries possessing large railway systems a selection based upon psychotechnical methods is already in use and is being developed successfully.

Railways that do not yet use psychotechnical methods for the selection of staff are those of :

Great Britain, United States of America, Egypt, India, China, Japan, France Alsace-Lorraine Rys. and P. O.-Midi Rys.), Luxemburg, Greece, Rumania, Finland and Holland.

The history of the development of psychotechnical selection in countries covered by the enquiry is as follows :

In *Italy* the well known biologist Angelo Mosso has set forth the psychological laws of fatigue, but it was only in 1918 that the medical department of the railways for the first time subjected railway employees to summary psychological examinations of their nervous system.

The head of the medical department at that time, Dr. G. FABBRI, issued regulations for admitting employees to office work, and in these regulations included besides other tests, examinations for sensibility, attention, perception, etc.

Concrete proposals regarding psychotechnical examinations were made by the consulting physicians (railway officers), Professors TANZI, DE SANCTIS, BRUGIA, MODENA, TIRELLI and others.

In 1924 Professor DE SANCTIS established several modulæ for the psychotechnical examination of drivers and firemen.

Attached to the Central Medical Bureau of the State Railways a psychotechnical laboratory was founded in 1934, specially equipped for examining railcar drivers. There has now been added to this special bureau a consulting phy-

sician for psychotechnics, viz. Professor PONZO.

Thanks to the work of the above-mentioned Professors, and to the collaboration of Professors FILIPPINI and BANISSONI, lectures were organized, and psychotechnics and professional guidance of railway staff were proceeded with.

However, only the following classes of personnel have to undergo psychotechnical tests : locomotive drivers, firemen and railcar drivers.

Official decrees were promulgated (circulars 4517, 4800 & 5089) for the purpose of regulating the psychotechnical examination of office employees.

The laboratory like all the other branches of the medical service comes under the purview of Dr. G. PAGLIANO, and is under the management of Comm. Dr. Azeglio FILIPPINI, assisted by Professor Mario PONZO, and Sr. FANELLI, Engineer.

In the course of their studies on the selection of railway staff, psychotechnical research workers have given preference to the individual analytical method. Nevertheless, the basic idea of recent research by Professor Ponzo has the merit of being all-embracing because it permits extending psychotechnical study of individual persons to that of their surroundings, i.e. it allows one to take into account all the circumstances, complete them, and thus attain the practical aim of such research work : safety in railway operation.

At the « Azienda Tramviaria » of Milan (A. T. M.) Professor CORBERI founded in 1925 a psychotechnical consulting-room where the tests are carried out.

Recently Professor MASSAROTTI has made certain changes in the research methods used by this Administration.

The results achieved by Professor MASSAROTTI have clearly proved the great utility of psychotechnical examinations, thanks to which the oper-

ating Department (thanks to the decrease in the number of accidents), is able to effect an annual saving of several millions of liras.

It may be said that Italy decidedly favours the development of psychotechnics.

Professors COLUCCI, GEMELLI, CREDARO, ORESTANO, PONZO, BANISSONI, BONAVENTURA, CASTELLI, SERGI, FUSCO, DE SALVO, RESTA, FERRARI, MUSATTI and many others are dealing with the greatest zeal with this science.

In *Spain* it was Sr. German ASUA, chief medical officier, who initiated psychotechnical tests of railway personnel. But it was only in 1934 that psychotechnical research was made use of for the selection, professional guidance and instruction of such staff.

The Madrid, Barcelona and Valladolid laboratories deal with the selection of apprentices and railcar drivers.

In *Great Britain* and the *United States of America* there is nothing in existence as regards psychotechnics applied to railway staff. Nevertheless, it should be pointed out that in these two countries great importance is attached to rational education of railway servants attached to operating services.

In *South America* there are no psychotechnical laboratories properly speaking, nor in *Egypt*. Railway authorities in those countries use good methods for the professional training of staff.

In *India* special care is taken with professional guidance of staff, who have to attend practical and theoretical courses.

In *China* and *Japan* there are professional training schools for railway servants.

In *Switzerland* obligatory psychotechnical examinations for the selection of the shop staff have been introduced in 1923; — *Czechoslovakia* (*State Rys.*) also introduced such examinations in 1923; then come : *Austria* (*Federal Railways*) in 1924; — *Jugoslavia* (*State Rys.*)

in 1926; — *France* (*Nord*) in 1933; (*Compagnie des Tramways de l'Ain*) in 1934; (*State*) in 1934; (*Paris-Lyon-Méditerranée*) in 1935; — *Rumania* (*State*) in 1936. The *Royal Hungarian State Rys.* apply psychotechnical methods for the selection of certain grades.

Railway-owned psychotechnical laboratories exist in : *Austria* (1); *France* : *Nord* (3), *Switzerland* (1 fixed laboratory and 2 travelling laboratories); in *Jugoslavia* (1); the *Czechoslovak State Rys.* have made an agreement with the Central Psychotechnical Institute, of Prague, whereby they can use this Institute's laboratory.

Psychotechnics applied to the selection of transportation staff were first introduced in *Germany* (in 1917), then in *Poland* (in 1925), in *Denmark* (in 1930), and in *Sweden* (in 1935).

The initiative for introducing psychotechnical tests on the railways in *Germany* and *Denmark* was impersonal (ordained by the Ministry of Communications or by the Railway Headquarters); in *Sweden* the initiator was Mr. Axel GRANHOLM, General Manager of the State Railways, and it was only in *Poland* that this initiative was taken by railway engineers, viz. by Messrs. B. SKUPIEWSKI, Chief Mechanical Engineer, and S. WASILEWSKI, head of the Mechanical Section at the Ministry of Communications.

Railway psychotechnical laboratories are mostly managed by higher officials either at the Ministry of Communications or the Railway Headquarters.

These are :

In *Italy* : Dr. FILIPPINI, Professor MASAROTTI (Milan Tramways); — in *Spain* : Dr. A. BUENO; — in *Austria* : Mr. AUDERIETH, engineer; — in *France* : Dr. LAUGIER (*State Rys.*) and Professor J. M. LAHY (*Nord*); — in *Switzerland* : Mr. P. KNOBLAUCH; — in *Czechoslovakia* : Professor F. SERACKY; — in *Germany* : Dr. Ing. M. DILGER, assisted by Professor W. MOEDE; — in *Poland* : up till 1936 Mr. J.

WOJCIECHOWSKI, engineer, and afterwards Dr. H. TARGONSKI (Warsaw) and Dr. W. KOWALSKI (Poznan); — and in Sweden : Dr. R. ANDERBERG.

In the present state of the application of psychotechnics to the selection of railway staff, we note that a psychotechnical examination is obligatory for the following categories of railwaymen :

In *Italy* : employees in the chief mechanical engineer's department (incl. locomotive running).

In *Spain* : apprentices and railcar drivers.

In *Austria* : all candidates before being admitted to the service; locomotive and railcar drivers, firemen, station-masters, assistant station-masters; employees in the operating and commercial services, signalmen, shunters in marshalling yards, guards, shopmen.

In *France* : State Rys., young apprentice candidates for the Chief Mechanical Engineer's department (incl. locomotive running), drivers of railcars or electric locomotives, signalmen and candidates for the operating department; Nord Ry. : signalmen and pointsmen, drivers of railcars and lorries, employees for the mechanical accountancy department, train guards, shunters and checkers.

In *Switzerland* : the same categories as in Austria.

In *Czechoslovakia* : locomotive drivers, railcar drivers, operating and commercial department personnel, technical and juridical staff, signalmen and pointsmen.

In *Jugoslavia* : candidates for the Zagreb Workshop School.

In *Germany* : loaders, shunting staff, signalmen and pointsmen, train staff, certain office staff, station-masters, booking clerks, forwarding staff, apprentices for the workshops, locomotive drivers, railcar drivers, etc.

In *Denmark* : candidates for the post of station-master or assistant station-master, administrative officials, locomotive

drivers, permanent-way men, railcar drivers.

In *Poland* : the lower and middle-grade operating staff, locomotive drivers and firemen, motorbus drivers, permanent-way men, station staff, signalmen and pointsmen, dispatchers, head shunters and employees of marshalling yards.

Official prescriptions for psychotechnical examinations are only published in a few countries (*Germany* and *Poland*). As regards consultative Committees at psychotechnical laboratories, there is only a Committee in *Germany*, composed of officials from the various Departments. In *Poland* lectures by psychotechnicians working in the laboratories are arranged. In case of need, professional specialists are invited to attend meetings of psychotechnicians.

Programmes of psychotechnical tests used for the various classes of railway employees are drawn up in *Austria*, *Denmark*, *Czechoslovakia* and *Poland*.

In order to avoid a repetition of these programmes, I will only mention the points that are common to the latter, thus showing the tests generally resorted to for the examination of specialists for the railway.

Tests for assistant stationmasters.

A. — *Collective tests* :

(1) Intelligence : Ebbinghaus test, logic test, execution of orders.

(2) Memory : for words, numbers, situations, orders.

(3) Attention : Couvé or Bourdon test, Kraepelin test, diffused attention test.

(4) Replying to a personal questionnaire.

B. — *Individual tests* :

(1) Ergo-dynamograph.

(2) Induction coil.

(3) Sphygmomanometer.

(4) d'Arsonval chronoscope.

(5) Stippling.

(6) Ticket board.

(7) Segregator.

(8) Observations in connection with the personal disposition (character).

In several countries tests that differ more or less and more or less numerous tests are applied, but their aim can be summarised under the above headings.

The same programme is adapted to examinations of station employees who have served the requisite period to become assistant station-masters.

Tests for locomotive drivers and railcar drivers, in respect of :

- (1) Intelligence.
- (2) Concentrated and diffused attention.
- (3) Memory.
- (4) Time of visual and auditive reaction.
- (5) Liability to fatigue.
- (6) Estimation of distances and speeds.
- (7) Technical intelligence.
- (8) Execution of orders.
- (9) Blood pressure.
- (10) Psychomotive aptitudes.
- (11) Multiple action.

These two examples of psychotechnical examination programmes prove that in spite of the enormous differences between programmes used in different countries, there is a general tendency towards standardization of the methods used for the examination of employees which have to perform special duties.

As regards the total outlay for psychotechnical examinations in 1935, the following figures may be given :

In *Germany* : (on a basis of 20 000 subjects examined annually and presuming the cost of an examination to be about 60 fr.), the outlay is 1 200 000 fr.

In *Austria* : 28 000 schillings (112 000 fr. approx.), viz. 13 schillings for each subject examined.

In *France* : State Rys. 240 000 fr.; cost

per employee : 100 to 150 fr. — Nord Ry. : 250 000 fr., or 200 fr. for each employee.

In *Switzerland* : 60 Swiss fr. (300 French fr.) per employee.

In *Czechoslovakia* : 20 000 crowns (26 000 fr.).

In *Poland* : 65 000 zlotys (approx. 260 000 fr.).

In *Sweden* : 6 000 crowns (33 000 fr.) or 4 crowns (22 fr.) per employee.

The number of employees examined by psychotechnical laboratories up to the end of 1935 is as follows :

Germany : 200 000; — Denmark : 400; — Poland : 14 000; — France : State Rys., 1 877; Nord Ry., 4 600; — Switzerland : 3 300; — Czechoslovakia : 5 467; — Yugoslavia : 1 240.

Most of the railways who apply psychotechnical selection use mathematical statistical methods to estimate the results of psychotechnical tests, these being classified under 4 headings : good, average, fair and unsuitable.

The lowest limit of professional capacity is as a rule « fair ». For the operating department this limit is generally raised.

As to the correlation between a psychotechnical estimate and the opinion of the respective Department concerning candidates examined, it can be said that as a rule the Managements consulted have merely indicated the percentage of concordance between the two opinions. As an example, in the case of the *Deutsche Reichsbahn* this percentage is 90; for the *Polish Railways* it is 70 and 92.

In many countries no statistical data concerning the effects of psychotechnical tests on the decrease in the number of accidents has been worked out. In Poland this decrease would work out at about 4.34 %. But it seems probable that psychotechnics must have contributed to this result to a larger extent. In order to ascertain the real extent of their effects it would be desirable to

frame a new method of drawing up statistics of accidents.

In almost all the countries there has been no opposition to the tests on the part of railway servants.

Railway authorities have agreed as to the utility of psychotechnical tests.

As regards professional orientation (guidance) based on psychotechnical tests, it must be admitted that this is not practised by Railway Administrations. In countries in which psychotechnics are used to some extent (Germany, France, Poland, Czechoslovakia and others) this fact is explained by the existence of professional training institutes which are capable of discerning the aptitudes of young candidates and of thus pre-directing them to the various railway departments.

It might be thought that the Managements of large railway systems could themselves undertake the entire work of preparing and training their staff.

If it is true that all the large railway systems have organised professional education, sometimes optional but in most cases obligatory, with periodical examinations, it must be admitted that such education although it constantly tends to become more perfected, is given to apprentices on rather varying lines.

I cannot better characterize the relationship between the training of railway servants and railway psychotechnics than by quoting the opinion of one of the Reporters, Mr. P. LO BALBO :

As regards selection, professional guidance and instruction of railway staff, in all countries covered by this report, candidates are required to show proof of general education in keeping with the initial position they are to occupy in the railway service; professional training of railway servants takes place while they are actually on duty, during probationary periods, and in most instances they ascend successively to the various grades. The results are satisfactory; but it is admitted that it is necessary, in the

first place, to select railway servants from those candidates who show the best signs of health and education, and in the second place to only admit to duties connected with the safety of operation such railway servants as have been considered fit to perform them after serving a practical apprenticeship.

But the experience of countries applying psychotechnics to the selection and training of railway specialists proves that this method is the most rational and economical.

III. — Conclusion.

The replies to the questionnaire sent out to all the Administrations who are members of the International Railway Congress Association show that psychotechnical methods for the selection of staff are actually resorted to in 18 countries, the Railways concerned operating 135 405 kilometres (84 140 miles) of lines.

Professional guidance of railway employees and their children is not applied anywhere.

The application of psychotechnical methods to professional training of railway specialists only exists in Germany, but the Railway Management has not given any precise information. It may be said that by the use of psychotechnical apparatus and methods, appreciable savings can be effected, and the training periods can be shortened.

The utility of psychotechnical methods is proved by the decreased number of accidents due to the human factor. It should be desirable to improve statistics of railway accidents, in order to make a strict distinction between causes that are purely human and those of other kinds (technical, physical, etc.).

Psychotechnics are applied gradually, although possibly slowly, by the European Railway Administrations, inasfar as they are considered as an indispen-

sable factor of rational selection of railway personnel.

IV. — Summary.

It would be advisable for the 1937 International Railway Congress to recommend :

1. that the Governments of all countries as well as all the Railway Administrations should use and apply psychotechnical methods in their public and private transport services;

2. that, in view of the heterogeneity of the methods used for examining railway servants in the various States, the Railway Psychotechnicians should undertake the elaboration and definite solution of the problem of creating a single

standard method of examining railway servants;

3. that an accidents statistics service be organised on a rational basis, with a view to increasing collaboration of psychotechnics with all scientific methods contributing to traffic safety;

4. that the desired importance be attached not only to the education of the staff and its professional guidance but also to labour conditions, to the somatophysiological qualities of movements, to the energy employed, to endurance to fatigue, to the study of the movements required for the performance of a given task, and finally to the possibility of developing the qualities of employees so as to increase their aptitudes for the performance of their railway duties.

SECTION V. — Light Railways and Colonial Railways.

[628. 61 (01)]

QUESTION XII.

Co-ordination of operation as between main-line and light railways,

by Mr. BELMONTE,
Special Reporter.

The present statement concerns a single report, drawn up by the writer with the efficacious collaboration of two eminent colleagues: Messrs. Tosti and Delille ⁽¹⁾. The undersigned therefore finds himself somewhat in the position of Cicero pleading *pro domo sua*. Nonetheless, it is in an equitable critical spirit that he intends to acquit himself of the task entrusted to him.

Preface.

The Reporters have to deal with a question that was already discussed at the preceding Congress (Cairo, 1933).

Whence their perplexity at now having to determine the scope of the subject and to define its limits, all the more because there seemed to be a marked tendency to give the widest, and consequently altogether imprecise, sense to the term « co-ordination of operation ».

That is why, whilst personally having a concrete and precise idea as to their task, they feared they might not be sufficiently supported by the general opinion.

They were thus obliged, in the first instance, to give an ample and comprehensive definition of light railways; in

the second place, after having compiled a questionnaire in accordance with their views, they added at the end of same a short chapter intended to ascertain where their conception was shared by those responding.

If the Reporters had desired to enlarge their investigation, which, we cannot deny, also has its attractive side, their task, encountering greater difficulties, not of facts but of interpretation, could only have covered an ensemble of practices, tendencies and resolutions as to which general agreement would never have been possible. Moreover, whilst these practices, tendencies and resolutions are of undoubted interest in particular instances, especially during the period through which Railways are at present passing, they would not have lost their nature of expedients and consequently could only have had a poor scientific basis.

Supported by the practical unanimity of the replies which confirmed their way of looking at the question, as set, the Reporters systematically expounded their contents, as already outlined by the questionnaire, and I personally do not see any objection to such procedure.

Naturally, the objection can be raised that the report deals with matters and facts known *lippis et tonsoribus*. However, the study of a question, without

⁽¹⁾ See *Bulletin of the Railway Congress*, May 1937, p. 1225/1.

it even being a question of new facts, always has the appreciable advantage of revealing the development stage it has reached. Next, the fact of condensing into a few pages the experience of a century of railway operation, as regards a given point of view, whilst being of restricted interest and scope, still enables one, in default of something better, to pursue a didactical aim which is not foreign to the *raison d'être* of our congresses.

Those are facts which the reporters did not overlook, as is shown by certain passages of their reports.

The Reporters thus set themselves the task of studying co-ordination of operation as between main-line railways and light railways, from a twofold standpoint: (a) reciprocal relations of carriers, each retaining his own personality and autonomy, and characteristics in keeping with the functions which each of them is called upon to fulfil; (b) relations between carriers and users. For convenience we have divided our report into three chapters.

I. — Installations and connections.

The reporters state the rule, dictated by equity, that it is the light railways which have to effect a junction with the main-line systems by means of a line leading into a station belonging to the latter. Interconnection is in most instances effected as the result of spontaneous agreement between the railway managements; in some countries it is governed by legal enactments.

When interconnecting two standard-gauge systems, with a view to obtain more efficient co-ordination, the best solution is a *joint station*. But, as the reporters remind us, the question of expense should never be lost sight of in matters of this kind, and they have considered it advisable to call the attention of readers to a provision of the Italian law which, whilst imposing upon secondary lines the duty of connecting

up with the main-line system, stipulates that such connection should only be effected by means of a joint station when the cost of adapting installations and the expenditure to be incurred for joint operation does not exceed the outlay required for the construction and operation of an independent station.

The use of a joint station thus being advisable, it appears to be good practice to use in common the existing installations of the main-line railway so as to reduce to a minimum the outlay for new installations, to be borne by the light railway.

Again, with the same object in view, it is obviously necessary to restrict joint use to those parts of the station considered necessary and sufficient for the service of the secondary railway.

A joint station for lines of different gauges does not appear to be advisable. Nevertheless, according to the layout of the small-gauge installations, a common use restricted to the sole part absolutely required for obtaining unity of management indispensable for operation may always be advantageous. And it is in this direction that the interconnection of two systems or lines having different gauges may cause a few variations as regards joint operation.

But when it is a question of completely isolated lines, having distinct stations in one and the same locality, a connection should preferably be made by a section of small-gauge track running into the main-line station, unless the passage of standard-gauge vehicles unto the light railway is done by means of transporter trucks, a fairly efficacious means of co-ordination, in particular for secondary lines of restricted length. In this case it is clearly advisable that the connecting line should be of standard gauge.

II. — Operating conditions.

Joint stations and separate stations.

For the operating services equally, co-

ordination finds a complete, practical and efficient solution in the creation of a joint station. All this is easy to organise and the only possible cause of disagreement is the apportionment of joint expenses, a question which goes beyond the scope of our enquiry and which the reporters have not stopped to discuss except in one particular instance which is not devoid of interest.

In the case of separate stations, the operations to be effected mainly consist of the exchange of goods: delivery by one management to the other, or else the transport of the goods exchanged or to be exchanged via the connecting line.

And here, basing themselves on their personal experience, the Reporters express the opinion that, even in cases of lines having the same gauge, it is advantageous for Administrations to leave it to the light railway to attend to haulage of rolling stock in both directions. The light railway achieves economy by a better use of its plant, transfer operations are carried out in the junction station without any special service by the main-line system, and responsibility is well defined.

When it is a question of lines built to different gauges, it is also advisable to entrust the light railway with the transshipment of goods, against payment by the main line of its share of loading and unloading expenses.

All this is of course on the tacit or expressed condition that the main-line system does not ignore nor neglect the requirements of the secondary line as regards exchange traffic and must be prepared, against equitable payment, to carry out in the junction station all operations likely to render the service of the light railway more regular, rapid or simple. This is specially necessary when exchange traffic reaches a certain importance and when the light railway consists, not of only one single line, but of a regular network of lines over

which traffic may be said to flow in several directions.

Combined services.

« Correspondence services ».

The connection between the main-line system and the light railway has as its complement a combined service, viz. the carrying of passengers and goods over the lines of two or more transporters, in succession by means of a single waybill.

The Reporters also call such services « through services ». But we shall not make use of this term here, in order to avoid the confusion which might arise from the intervention of international transport; now the latter is not comprised in the task set to the reporters.

After having explained the reasons for which greater extension has been given to combined services for goods transport than to passenger transport, the Reporters stress the bonds of solidarity which ought to unite all transporters participating in combined services, as regards relations with railway users. It should be noted that, in countries in which a junction between railways is not enforced by law but is the result of their own free will, the combined service, which is the immediate consequence of same, would lose its significance from the standpoint of co-ordination, if agreements between managements did not offer their clients their joint responsibility and appear in the guise of one single railway undertaking, while agreeing among themselves as to how this responsibility is to be shared.

A substitute for a combined service is the so-called « correspondence » service, re-dispatching, or « re-registration ».

The difference in gauge, the constructional gauge and the kind of track, involving appreciable restrictions on the running of rolling stock belonging to the main system over the lines of the

light railway, might offset to a large extent the advantages of a combined service, because under such circumstances the operation of lines in contact with one another is so different that it is not possible to bring about a reciprocal compensation for services carried out. On the other hand, these same circumstances mean that Administrations are less disposed to grant, for the settlement of accounts, the long terms inherent to a combined service.

With a « correspondence » service it is nevertheless possible to give railway users the advantage of effecting transport using the lines of several companies without their having to intervene at tranship stations. And agreements between carriers can facilitate transportation to the extent of rendering a « correspondence » service an important factor of co-ordination.

Rates. — Routing.

The Reporters believe in the principle that each carrier should apply his own tariffs on his own system and that each railway should, in addition, retain its freedom from a tariff standpoint. They state one single reservation (at the present time when railways are threatened by keen competition from road transport, which is particularly felt by the smaller railways) concerning secret agreements made for joint interests. Such agreements can always be made on condition that reciprocal rights and the interests of the community are respected.

They next point out that co-ordination of operation does not absolutely demand equality of basic tariffs to be applied to both sections of the route; consequently the question of the method of calculating the charge for the total transport, i.e. by adding separate charges or in the form of an all-round charge, loses its importance.

This latter method of reckoning, which

is only applicable when the basic rates are identical, appears to be preferable because it is more simple and lends itself to elimination of certain difficulties concerning the routing of consignments, as we shall see further on. But it finds its stumbling block in the sharing of receipts.

A sharing proportional to the respective runs is not only unremunerative to light railways but makes the share devolving on the latter dependent upon the more or less long transport over the main-line system. The Reporters possibly lay too much weight on this latter fact and make no mention of other systems of sharing, but which also have drawbacks. One of these methods appears to consist, for instance, in dividing the total rate proportionally to the rates which would be applied by each railway to its own section (or run), as if it were a case of internal transport.

Under the heading of routing, the Reporters, dealing with the case of a light railway line or system connected to a main-line system at two or more stations, enter the lists in favour of routing in the manner most favourable to the consignor, contesting the right of a railway having a consignment to forward, to despatch it to the consignee over its own lines, to the detriment of another railway possessing a shorter or cheaper route. This right, derived from *English Common Law*, has certainly lost its pertinency nowadays. But here we are touching the question of competition between railways, with all the distinctions and exceptions which have caused a backbiter to state that the science of tariffs is an esoteric science; this question has, moreover, only a generic relationship with co-ordination.

Use of rolling stock. Containers.

The connection between two lines and a combined service would not be sufficient elements of co-ordination without the possibility of exchanging rolling

stock. The Reporters state that agreements in respect of such exchange exist in all countries ; that this result has been achieved without legal obligation; and that, for this purpose, many light railways having built to a narrow gauge make use of transporter trucks.

Thanks to the exchange of rolling stock, goods travel to their destination station in the same wagon into which they were loaded at the departure station, thus avoiding transshipment and loss of time for minute verifications.

The Reporters then go, in detail, into methods of effecting exchange of both goods wagons and passenger coaches. And in regard to the latter traffic they state they are in favour of whole light-railway passenger trains completing their run over sections of line belonging to main-line systems; they add a few indications as to the system to be adopted.

As to transport of goods by means of containers — a term now used currently in railway language — although this question has hardly past the experimental stage, the Reporters recommend the use of this method of transport because of its great utility in given cases.

And since we are on the topic of forecasts, we might mention another modern practice, with an eye to co-ordination : that of road vehicles which might, under certain circumstances, be used for exchanging wagons between two railways not connected by a railway line.

III. — Accessory services.

This chapter has been dealt with from the special aspect of road motor competition acting as a stimulant. It is a matter of questions which are not of great importance as regards co-ordination. They are what one might term subsidiary questions, but which have nevertheless to be taken into consideration owing to growing competition, due as we know not to technical characteristics

of railways, but to the state of inferiority in which they find themselves from a legal point of view.

The Reporters mention three main points. As to the first : the acceleration of combined transport, although it is a special factor of the acceleration of delivery in general, we do not consider it necessary to again discuss it here. Accessory services, which form the second point, are worthy of brief mention. Whilst mentioning the autonomy possessed by motor lorries, which enables them to carry out a complete door-to-door service, the Reporters stress the necessity of intensifying and improving collection and delivery services in particular, and that is the most important problem for light railways. Factors that cannot be overlooked in this respect are containers, and, I would also add personally, road vehicles.

The third point concerns the reduction of expenses by the elimination of all redundant operations and by simplification, notably as regards accountancy, with the introduction of common clearing offices.

* * *

Summary.

Without adding anything to them, I submit the very summary drawn up by the Reporters, except for one or two very slight alterations to clauses 7 and 15. This summary is as follows :

1. In all countries, co-ordination of operation of the main-line and secondary railways is recognised, in principle, as not only useful, but necessary in the general interest.

2. It is generally considered as an effective means of meeting the growing competition of other more modern methods of transport.

With particular regard to the *installations* :

3. In the case of two railways of the same gauge, it is preferable to have common junction stations in which the existing equipment of the main-line railway is used to cover the needs of the secondary railway.

4. In the case of railways of different gauges, with separate stations near one another, the narrow-gauge line should run into the main-line railway station, unless transporter trucks are used; in this case it is desirable that the connection should be a standard-gauge line.

As regards *operation* :

5. Both in joint stations and in separate stations connected together, the main-line railway should co-operate with the light railway to the maximum possible extent, in return for suitable compensation.

6. Through (interchange) traffic should be dealt with under a combined-service system, with a single transport contract (waybill) and joint responsibility of the carriers.

7. When a combined service is impossible or inconvenient, the carriers should make agreements about correspondence services for carrying goods without intervention of the parties concerned at the junctions, fixing according to the best interests of the users the limits of responsibility and competency of each carrier, administratively and legally.

8. It is desirable that the carriers should control their own rates and on the basis of these rates, each carrier should receive the amount due for the services actually carried out on his line.

9. It is always better for through transport to follow the cheapest route, unless this seriously interferes with prompt delivery.

10. It is not desirable in principle to enforce transit in the case of through traffic, even when the transit route is the shortest.

11. When common stock and the indiscriminate use of goods wagons are not considered advantageous, railways of the same gauge, provided safety is not affected, should make agreements for the reciprocal exchange of goods wagons, or at least for running main-line vehicles over the secondary railway.

12. In the case of narrow-gauge railways, carriage on transporter trucks or in containers may very effectively prove an adequate corrective of the difference in gauge.

13. In the case of passenger services, connecting the light railway with important centres on the main-line railway by means of trains continuing over sections of the main-line can be tried with profit.

As regards *competition*, conjointly with the more important means investigated by the technical services to get the best out of co-ordination, the following can be recommended :

14. The main-line railway should co-operate to the maximum extent in increasing the average speed of goods in through traffic.

15. The greatest possible extension should be given, by both the main-line and secondary railways, to accessory services making possible door-to-door transport, using if need be containers and road vehicles.

16. Whilst safeguarding the autonomous organisation of each railway, the accountancy work should be simplified as far as possible and the particular branches of the services should be combined in order to eliminate duplication.

QUESTION XIII.

Specifications for the fixed plant of railways with light traffic, intended to prevent the use of unnecessarily expensive track equipment, and generally to give economical working,

by A. SVOBODA,
Special Reporter.

This question was dealt with in two reports :

Report by Mr. VAN NOORBEECK ⁽¹⁾ (Great Britain, Dominions and Colonies, America, China and Japan), and

Report by Mr. SVOBODA ⁽²⁾ (Continental Europe and Colonies, Egypt).

The common questionnaire, which we have drawn up in agreement with Mr. VAN NOORBEECK was sent to 200 Railway Administrations operating together 523 363 km. (325 200 miles) of lines. Replies were received from 53 Administrations operating a total of 89 630 km. (55 700 miles) of lines carrying light traffic. We wish to mention also that we received, after our report was published, replies from 5 Companies working 3 662 km. (2 775 miles) of light-traffic lines, and that we regret we were unable to take them into account when drawing up our report.

* * *

Question XIII in fact refers to two problems which are closely related, a technical problem and an economic problem.

That is why both Reporters deemed it advisable also to investigate the most

suitable operating methods, although the wording of the question mainly refers to the *fixed plant* for such lines.

The joint questionnaire, drawn up by the author, referred to the following three main points :

(1) An analysis of the definition of « Railways carrying light traffic ».

(2) An analysis of the problem itself, viz. the definition of means by which it would be possible to achieve economies on the « fixed plant ».

(3) An investigation into the question as to which are the most suitable methods for operating the traffic on the said lines.

As regards point 1, at the beginning of the reports, their authors have endeavoured to define the kinds of railways which come or can come under the designation of « Railways carrying light traffic ».

The object of this analysis was to avoid possible misunderstandings seeing that in this category one might also include main lines that are little used.

Taking into account the information contained in the replies that were sent to the two Reporters, and also having regard to the discussions at previous Congresses in connection with such definitions, it can be said that in the category of « railways carrying light traffic » it is possible to include — with the exception of main lines and purely touristic

(1) See *Bulletin of the Railway Congress*, November 1936, p. 1325/1.

(2) See *Bulletin of the Railway Congress*, March 1937, p. 759/5.

lines — on principle, all other railways which are open to any public traffic, or to a restricted public traffic.

We consider that to make a useful comparison it is advisable also to take into account the fact that the respective railways are connected at one or several points with the main lines (exchange of vehicles) or not. From this point of view we compared, in the synoptical table appended to our report, the respective data arranged according to the track gauge.

The Railway Managements who sent in replies to the reporters (in all 53 Administrations) operate lines built to 14 different gauges: 600 mm., 750 mm., 760 mm., 785 mm., 900 mm., 950 mm., 1 000 mm., 1 050 mm., 1 067 mm., 1 100 mm., 1 435 mm., 1 440 mm., 1 445 mm., and 1 676 mm. (1' 11 1/2", 2' 5 1/2", 2' 5 7/8", 3' 3/32", 2' 11 1/2", 3' 1 3/8", 3' 3 3/8", 3' 5 3/8", 3' 6", 3' 7 5/16", 3' 8 1/2", 4' 8 45/64", 4' 8 29/32", and 5' 6"). There is one European Railway which operates a mixed track having a 1 000/1 440-mm. (3' 3 3/8"—4' 8 45/64").

(2) As regards the problem of defining suitable means for effecting economies on fixed installations the methods proposed can also be applied to little-used lines of the large systems.

The question set has been analysed from three points of view:

- (a) of initial cost of the line,
- (b) maintenance,
- (c) operation.

Taking the opinions of the two Reporters as a basis, we feel we may state that the wording of question XIII mainly refers to fixed plant which, by the fact of being operated, is liable to wear and tear and which consequently has to be renewed periodically.

In that class of fixed plant there should consequently be included the permanent way, signalling and safety

installations, and telegraph and telephone plant.

In order to make this investigation as complete as possible, an analysis has been made of all circumstances connected with the study of question XIII, viz. equally the nature and extent of fixed plant which has a comparatively long life, i.e. which hardly ever needs to be renewed (e.g. the track substructure, buildings, viaducts, etc.).

As regards a comparison of fixed plant, we would refer readers to the reports.

(3) It is evident that operating methods are an important factor to be considered when devising means for effecting savings on the working expenses.

It appears from the replies of the Railway Administrations concerned that when dealing with passengers on railways carrying light traffic it is advisable to give preference to railcars instead of trains hauled by locomotives, which latter should only be used according to local circumstances, to meet goods traffic requirements.

We are of opinion that the solution of the most suitable operating methods decidedly depends on the particular conditions prevailing on each Railway.

There is no doubt that the effect of the modern technical progress which resulted in the introduction of automobiles and aircraft prompted the railways to also devise fast methods of transport and adopt the railcar. They remain nonetheless dependent on locomotives when the traffic to be dealt with consists of bulky goods to be carried long distances with the required operating speed, simplicity and economy.

It is therefore a matter of two opposed circumstances to which railways have to suit themselves, in view of local conditions which are in this sense quite decisive.

So far, the results obtained on secon-

dary railways favour the development of railcar operation.

Although it is a question of lighter vehicles, viz having a lower axle load than locomotives, it cannot be argued from this fact that the use of a lighter permanent way is thereby made possible. It should be borne in mind that the running speed of railcars is higher than that of ordinary trains and that, for this reason, dynamic stresses set up in the track are increased.

SUMMARY.

Mr. VAN NOORBEECK, in his report, states that the selection of the gauge depends on the importance of the traffic to be dealt with, on the gauge of neighbouring railway systems, as well as on various local circumstances. In his opinion the 1-m. and 1.067-m. (3' 3/8" and 3' 6") gauges seem to give the best results.

As regards the weight of rails, this should not be less than 20 kgr. per metre (40.3-lb. per yard) with 32 kgr. (64.5 lb.) as a maximum. Rails less than 9 m. (30 ft.) long should not be used.

In his opinion, gradients exceeding 1 in 33 are not recommended. The radius of curves should not be less than 30 m. (1 1/2 chains).

The use of treated wood sleepers and broken stone or stone chippings is to be recommended.

Points and crossings should be robust. The latter can be protected by hand signals, and points be simply padlocked and hand-operated.

The fencing in of the lines, except in the stations, is the more unnecessary, that the train speed is generally low (25 to 45 km.) (15 to 28 miles) an hour.

For the same reason, level crossings in most cases can be protected simply by the international sign picturing a locomotive, without gates.

The buildings should be limited to

those absolutely necessary for the operating and rolling stock departments.

At intermediate stations, buildings are not needed in many cases, platforms edged in concrete being sufficient to meet the requirements.

Signals protecting trains when entering or leaving the stations do not appear to be necessary.

The padlocked points can be worked by the station or train staff.

Signals interlocked with the main-line signals are only justified at important junctions with the main line.

The safety and regularity of the traffic over single-track lines is amply ensured by the ordinary or electric train-staff system, completed in some cases by a telephone line between the different stations.

II. According to the conclusions of our own report, economical operation might be obtained as a rule, by the following means :

(a) *Directly :*

1. by adopting a lay-out (location) that will entail the lowest possible operating costs;

2. by equipping the line, especially as regards the track, in such a way as to require the least maintenance.

3. by not mechanising the operations in all cases where the staff have to be on duty for other reasons, and can carry out the work.

4. by adopting the point of view that State or other authorities, or users should bear the first cost of equipment adopted in the public interest, or not exclusively required for railway purposes.

(b) *Indirectly :*

5. by adopting suitable operating methods;

6. by introducing such economical methods in the traffic department as re-

quire the least equipment and the smallest staff.

We can sum up briefly the tendencies of the railways to lower working costs on the whole, as follows :

The working must be made as scientific and economical as possible, taking full advantage of everything practice and technical progress has to offer, especially all methods and equipment offering better conditions as regards not only savings, but also traffic acceleration and increased safety.

In order to effect the largest savings, the safety equipment should be such that it can be operated in the shortest possible time over the largest area (central interlocking frames) the human factor being reduced to a minimum. Whilst the latter principle is most important, it must not be applied at the expense of safety.

In order to arrive at the best results as regards the analysis of the problem, in which all the Railways are interested, we feel this would be best attained by comparing the conditions on all railways. This means that the whole of the Railways should answer the questionnaires sent them.

We are persuaded that in the interest of all Railway Companies more valuable and more instructive results would be obtained in this way.

On the other hand, in the course of our report, we recommended the following measures, which we justified in each case :

(1) as regards *gradients*, the operating expenses which are of a recurrent nature should be given consideration above all.

(2) omit *straight intermediate sections* in the case of reverse curves provided with transition curves;

(3) *standardisation of track equipment* should be sought for in order to reduce the number of types and reserve equipment;

(4) on lines carrying light traffic use

of heavier track equipment withdrawn from main lines at the time of renewals, in order to obtain easier and cheaper maintenance ;

(5) use *rail welding* ;

(6) adapt the dimensions of the *road-bed and ballasting* to the track gauge;

(7) come to agreements with the respective Governments in order that the initial cost of *modern safety equipment at level crossings* shall be borne by those responsible for the maintenance of the roads in question;

(8) provide *halts*, part of the expenditure involved being borne by the users concerned;

(9) use *dry cells* for the electric lighting of signals and telephone installations;

(10) install *appliances for the mechanisation of operations*, provided that the saving to be effected will at least counterbalance the interest and amortization of the capital invested;

(11) give preference to *bronze wire*, over steel wire, for telephone lines;

(12) use the *dispatching system* by means of a suitable telephone system;

(13) use *railcars* for passenger traffic, according to local circumstances;

(14) before coming to a decision, take into account not only the cost of installation and renewals, but also operating expenses which constitute a preponderating factor.

The analysis of the results of our investigation regarding the practice on the Railways consulted, enables us — in our opinion — to supplement the above recommendations and the conclusions arrived at by the two Reporters in the following way :

Appliances enabling trains to operate automatically the points when running over a turnout allow of savings in working expenses being effected. (We are

prompted to formulate this conclusion by the very favourable results obtained from the use of such devices, according to the additional information we have received from the Railways concerned.) The speed of the vehicles approaching points equipped with such appliances should be reduced — according to tests carried out — to about 10 km. (6.2 miles) an hour.

Safety, signalling, telegraph and telephone appliances must be adapted to the operating requirements. Whilst every effort should be made to obtain as economical working as possible, we cannot however support the opinion that they should be dispensed with in a general way (e.g. fixed signals). We have in mind here, for instance, connecting stations and junctions on the open line, which must be provided with home signals for safety purposes. We would also add that, before taking a decision, on this subject local circumstances should be taken into account (number

of trains, number of train crossings, train speeds, etc.).

*
* *

In view of the fact that certain Administrations have pointed out in their replies that « fixed plant » on their lines has already been reduced to a minimum and that for this reason it was very difficult to further reduce it without endangering traffic safety and regularity, we wish to state that, in our opinion, it is in this instance not only a matter of studying simplification of « fixed plant » but also the *renewal* of plant subject to wear and tear, by equipment that has proved itself more suitable as the result of experiments, or of completing the equipment of certain lines by certain installations (e.g. telephones of modern types, etc.) which, thanks to the technical progress achieved, provide better means for attaining the object sought. The same standpoint can be applied to operating methods.

MONTHLY BIBLIOGRAPHY OF RAILWAYS ⁽¹⁾.

PUBLISHED UNDER THE SUPERVISION OF

P. GHILAIN,

General Secretary of the Permanent Commission of the International Railway Congress Association.

(JANUARY 1937)

[016.385.(02)]

I. — BOOKS.

In French.		
1936	656 .24	
ZE (J.).		
Responsabilité en matière de transport des bagages par chemins de fer, sur routes, par air, par mer et au point de vue international.		
Paris (Ve), Librairie du Recueil Sirey, 22, rue Soufflot. 1 volume.		
1936	621 .392	
MELLER (Ch.).		
Manuel de la soudure à l'arc.		
Paris, Dunod, 92, rue Bonaparte. 1 volume, 182 pages et 82 figures. (Prix : 45 fr. français.)		
1936	313 .385 (.437)	
Statistique des Chemins de fer tchécoslovaques pour 1935.		
Praha, Ministère des Communications. 1 volume, 53 pages et 1 carte.		
1936	385. (02)	
UJA, et MAROIS.		
Cours de Chemins de fer. 5 ^e partie. Exploitation technique. 2 ^e édition.		
Paris, Léon Eyrolles. 1 volume, 336 pages et 211 fig.		
1936	625 .23 & 669 .1	
Voitures métalliques.		
Bruxelles, Simar Stevens, avenue Coghén, 29. 1 volume, 48 pages et figures.		
In German.		
1936	691 & 721 .9	
MÖRSCH (E.).		
Der Eisenbetonbau. 2. Band, 3. T. : Statik der Gewölbe und Rahmen. 2. Lieferung.		
Stuttgart, Konrad Wittmer. 1 Band, 164 Seiten und Abbildungen. (Preis : 9 R.M.)		
1936	691 & 721 .9	
MUND (O.) und COLBERG (O.).		
Handbuch für Eisenbetonbau. 4. Auflage, 4. Band, 1. bis 5. Lieferung : Stützmauern-Grundbau.		
Berlin, Wilhelm Ernst & Sohn. 1 Band, 479 Seiten und 465 Abbildungen. (Preis : 1. bis 4. Lfg. je 6.60 R.M. 5 Lfg. 8 R.M.)		
1936	691 & 721 .9	
NEUMANN E.), SIEBERT (B.), ROLOFF (M.), KÖGLER (F.) und HARTMANN (Fr.).		
Handbuch für Eisenbetonbau. 4. Auflage, 12. Band, 4. Lieferung : Strassen-, Eisenbahn, Berg- und Tunnelbau.		
Berlin, Wilhelm Ernst und Sohn. 1 Band, 64 Seiten und Abbildungen. (Preis : 4.40 R.M.)		
1936	656	
PIRATH (C.).		
Der Nachtluftverkehr.		
Berlin, Verkehrswissenschaftliche Lehrmittelgesellschaft m. b. H. bei der Deutschen Reichsbahn. 1 Band, 64 Seiten und Abbildungen.		
1936	621 .33	
WECHMANN (W.).		
Das elektrische Eisenbahnwesen der Gegenwart.		
Berlin S. W. 68, Sozialpolitik, Wirtschaft und Statistik. 1 Band, 160 Seiten und 350 Abbildungen. (Preis : 6 R.M.)		
In English.		
1936	697	
ALT (H. L.).		
Practical air conditioning.		
Chicago, Domestic Engineering Co. (5 × 8 inches), 259 pages, diagrams, charts, tables. (Price : \$ 1.00.)		
1936	624 & 625 .13	
Bridges or tunnels — which ?		
New-York. Published by the American Institute of Steel construction.		

(1) The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress conjointly with the Office Bibliographique International, of Brussels. (See "Bibliographical Decimal Classification as applied to Railway Science", by L. WEISSENBACH, in the number for November 1897, of the *Bulletin of the International Railway Congress*, p. 1509).

1936
CAHILL (E. G.), RIDGWAY (Robert) & BRAHDY (Alfred).
 Rapid transit for San Francisco.
 San Francisco, Cal. Published by the San Francisco Public Utilities Commission.

1936 **621 .9 (02)**
COLVIN (F. H.) & STANLEY (F. A.)
 Turning and boring practice.
 London. McGraw-Hill Publishing Co. Ltd. (Price : 24 sh. net.)

1936 **669 .1**
DAWE (Charles Newman).
 The steel physical properties atlas.
 Cleveland (Ohio). Published by the American Society for Metals. (8 1/2 × 11 inches), 87 pages, tables, color charts.

1936 **614**
DRINKER (Philip) & HATCH (Theodore).
 Industrial dust.
 New York. Published by McGraw-Hill Book Co., Inc. (6 × 9 inches), 316 pages, photographs, charts, tables. (Price : \$ 4.00.)

1936 **656**
DUNCAN (C. S.).
 National transportation policy.
 New York and London. D. Appleton-Century Co. (5 × 8 inches), 315 pages, tables. (Price : \$ 3.00.)

1936 **0 : 62. (06)**
 Engineering abstracts from the current periodical literature of engineering and applied science, published outside the United Kingdom. Published by The Institution of Civil Engineers with the co-operation of other engineering societies in Great Britain and the Dominions. No. 68, June 1936.
 London, S. W. 1. The Secretary, Institution of Civil Engineers, Great George Street. (Price : 6 sh.)

1936 **385. (08 (.66))**
GOLD COAST RAILWAY AND TAKORADI HARBOUR.
 Administration report for the year 1935-36.
 Takoradi (Gold Coast). Gold Coast Railway General Manager's Office. 107 pages, a map & tables.

1936 **385. (08 (.52))**
GOVERNMENT OF JAPAN. DEPARTMENT OF RAILWAYS.
 Annual report for the year ending March 31st, 1935. (English edition.)
 Tokyo. Published by the Department of Railways. 321 pages, diagrams & tables.

1936
GREENE (A. M.), Jr.
 Principles of heating, ventilating and air conditioning.
 New York. John Wiley and Sons. (6 × 9 inches), 44 pages, diagrams, charts, tables. (Price : \$ 4.50.)

1936 **621 .**
IBBETSON (W. S.).
 Accumulator charging. Maintenance and repair.
 London. Sir Isaac Pitman & Sons, Limited. Fifth edition. (Price : 3 sh. 6 d. net.)

1936 **385 .11 (.42)**
NEWLANDS (Alex.).
 The British Railways.
 London. Longmans, Green and Company. (Price : 7 sh. 6 d. net.)

1936
RIES (Heinrich) and the late WATSON (Thomas L.).
 Engineering Geology. Fifth revised edition.
 New York. Published by John Wiley & Sons, Inc. (6 × 9 inches), 750 pages, halftones, linecuts, tables. (Price : \$ 5.00.)

1936 **625 .11 (0)**
SEARLES (W. H.).
 Field engineering. A handbook of the theory and practice of railway surveying, location and construction. Vol. I. Twenty-first edition. Revised and enlarged by H. C. IVES.
 New-York. John Wiley & Sons. (4 × 7 inches), 44 pages, diagrams, charts, tables, leather. (Price : \$ 4.00.)

1936 **55 & 721**
 Soil mechanics studies.
 Tokyo. Government Railways of Japan. Research Office. Bulletin No. 4.

1936 **62. (01 & 6)**
TIMOSHENKO (S.).
 Theory of elastic stability.
 New York and London. Published by McGraw-Hill Book Co., Inc. (6 × 9 inches), 518 pages, halftones, linecuts and tables. (Price : \$ 6.00.)

1936 **385. (08 (.66))**
UNION OF SOUTH AFRICA.
 Report of the Central Road Transportation Board for the year ended 31st March, 1936.
 Pretoria. Printed in the Union of South Africa by the Government Printer. 40 pages and tables.

1936
ZEERLEDER (A. V.).
 The technology of aluminium and its light alloys.
 New York. Published by Gustav Fock. (6 × 9 inches), 301 pages, halftones, linecuts, tables. (Price : \$ 5.50.)

[016.385. (05)]

II. — PERIODICALS.

In French.

Bulletin des transports internationaux par chemins de fer. (Berne.)

1936 **313 .385 (.494)**

Bull. des transp. intern. par ch. de fer, novembre, p. 513.
Statistique des Chemins de fer fédéraux suisses pour 1935. (300 mots.)

Bulletin technique de la Suisse romande. (Vevey.)

1936 **621 .132.8 (.494) & 621 .43 (.493)**

Bull. techn. de la Suisse romande, 15 octobre, p. 5.
Le développement des **automotrices** à la Société Nationale des Chemins de fer belges. (3 000 mots, fig. & 1 carte.)

Electricité. (Paris.)

1936 **621 .392**

Electricité, novembre, p. 405.
La **soudure électrique** par points de l'aluminium et de ses alliages. (1 300 mots & fig.)

1936 **669**

Electricité, novembre, p. 406.
Le **traitement thermique** avec programme de température. (2 800 mots & fig.)

Génie civil. (Paris.)

1936 **691**

Génie civil, n° 2831, 14 novembre, p. 431.
FERET (R.). — Une méthode pratique pour fixer la composition des bétons. (2 200 mots & fig.)

1936 **62. (01 & 669)**

Génie civil, n° 2831, 14 novembre, p. 433.
GUILLET (L.). — Les tendances nouvelles dans l'étude des **propriétés mécaniques des métaux et alliages**. (4 500 mots & fig.)

1936 **656 .211.7 (.42 + .44)**

Génie civil, n° 2832, 21 novembre, p. 456.
Les **ferry-boats** de la ligne de Dunkerque à Douvres. 1 800 mots & fig.)

1936 **656**

Génie civil, n° 2832, 21 novembre, p. 459.
La route, le rail et le **combustible**. (1 700 mots.)

1936

626. (.493)

Génie civil, n° 2833, 28 novembre, p. 479.

La construction des **grandes écluses** du Canal Albert, en Belgique. (3 800 mots & fig.)

1936

669 .1

Génie civil, n° 2833, 28 novembre, p. 486.

JACQUÉ (L.). — **Propriétés mécaniques des aciers** traités par l'hydrogène chaud sous pression. (1 000 mots & fig.)

L'Allègement dans les Transports. (Lucerne.)

1936

625 .234

L'Allègement dans les transports, novembre-décembre, p. 142.

BILEK (J.). — **Chauffage électrique** de remorques d'automotrices, sur la base d'isolation et de distribution réglable de la chaleur accumulée. (1 900 mots & fig.)

1936

625 .3 (.494)

L'Allègement dans les transports, novembre-décembre, p. 148.

HAEFNER (C.). — Transformation et augmentation de la **capacité du téléferique** de Beckenried-Klewenalp. (1 500 mots & fig.)

1936

625 .2

L'Allègement dans les transports, novembre-décembre, p. 154.

KREISSIG (E.). — Geschlossene Träger beim **Eisenbahnwagenbau**. (3 400 mots & fig.) (A suivre.)

Les Chemins de fer et les Tramways. (Paris.)

1936

621 .131.2

Les Chemins de fer et les Tramways, novembre, p. 176.
Considérations sur les prototypes de locomotives et l'entretien des machines actuelles. (3 600 mots.)

1936

621 .43

Les Chemins de fer et les Tramways, novembre, p. 178.
La transmission mécanique dans les **automotrices Diesel**. (3 200 mots.)

1936

621 .134.3

Les Chemins de fer et les Tramways, novembre, p. 182.
Disposition permettant de faire varier la compression dans des **locomotives à distribution par soupapes**. (4 000 mots & fig.)

1936

621 .135.4 & 625 .215

Les Chemins de fer et les Tramways, novembre, p. 186.
RACZ (E.). — La marche en courbe du matériel des **chemins de fer**. Détermination des efforts en résultant sur les châssis et bogies. (5 000 mots & fig.) (A suivre.)

- 1936** **385. (09 (.59)**
Les Chemins de fer et les Tramways, novembre, p. 190.
CHARRIN (V.). — Les voies ferrées d'Indochine.
(1700 mots & fig.)

L'Industrie des voies ferrées et des transports automobiles. (Paris.)

- 1936** **385. (09 (.64)**
L'Ind. des voies ferrées et des transp. autom., octobre, p. 217.
VENTE. — Les chemins de fer au Maroc. (13 000 mots, fig. & cartes.)

Revue universelle des Mines. (Liège.)

- 1936** **624 .2**
Revue universelle des mines, novembre, p. 452.
DEMARS (C.). — Poutres de section constante à une liaison surabondante. Formules. (500 mots.)

Traction nouvelle. (Paris.)

- 1936** **621 .43**
Traction nouvelle, novembre-décembre, p. 183.
DUMAS (L.). — Rapides type franco-belge. (6 000 mots & fig.)

- 1936** **621 .43 (.44)**
Traction nouvelle, novembre-décembre, p. 192.
Le centre d'autorails de Lyon. (1 200 mots & fig.)

- 1936** **621 .43 & 625 .234**
Traction nouvelle, novembre-décembre, p. 214.
Le chauffage par « air pulsé » dans les autorails. (1 200 mots & fig.)

In German.

Die Lokomotive. (Wien.)

- 1936** **621 .132.1 (.42)**
Die Lokomotive, Nr. 11, November, S. 197.
Die neueren Lokomotiven der London, Midland und Schottischen Eisenbahn. IV. (7 000 Wörter & Abb.)

- 1936** **621 .335 (.439)**
Die Lokomotive, Nr. 11, November, S. 207.
Die elektrischen Lokomotiven der kgl. ung. Staatsbahnen nach dem Kando'schen Phasenumformer-system. IV. (2 100 Wörter.)

- 1936** **621 .43 (.438)**
Die Lokomotive, Nr. 11, November, S. 209.
Daimler 4a Schnelltriebwagen für die Polnischen Staatsbahnen. (1 500 Wörter & Abb.)

Die Reichsbahn. (Berlin.)

- 1936** **385 .1 (.3)**
Die Reichsbahn, Heft 47, 18. November, S. 1007.
Die Lage der Eisenbahnen im Jahre 1935 gegenüber 1934 und 1933 und ihre finanzielle Entwicklung in den ersten Monaten 1936. (3 600 Wörter.)

Elektrische Bahnen. (Berlin.)

- 1936** **621 .33**
Elektrische Bahnen, Oktober, S. 247.
SCHMER (K.). — Stromversorgungsmöglichkeiten bei Bahnelektrisierung. (8 000 Wörter & Abb.)

- 1936** **621 .33 (.485)**
Elektrische Bahnen, Oktober, S. 259.
ÖFVERHOLM (I.). — Die Umformerwerke für den elektrischen Zugbetrieb der Schwedischen Staatseisenbahnen. (4 300 Wörter & Abb.)

Glaser's Annalen. (Berlin.)

- 1936** **656 .225 & 656 .261**
Glaser's Annalen, Heft 9, 1. November, S. 113.
BODE (W.). — Fahrzeuge zum Befördern von Eisenbahnwagen auf der Strasse. (4 300 Wörter & Abb.)

Organ für die Fortschritte des Eisenbahnwesens. (Berlin.)

- 1936** **385. (06 .12)**
Organ für die Fortschr. des Eisenbahnw., Heft 22, 15. November, S. 447.

- BLOSS. — Die Technikerversammlungen des Vereins Deutscher Eisenbahnverwaltungen und ihr Wirken. (4 400 Wörter.)

- 1936** **625 .14 (09)**
Organ für die Fortschr. des Eisenbahnw., Heft 22, 15. November, S. 457.

- MASER. — Der Oberbau in den ersten 18 Jahrgängen des Organs 1846 bis 1863. (7 000 Wörter & Abb.)

- 1936** **621 .13 (09)**
Organ für die Fortschr. des Eisenbahnw., Heft 22, 15. November, S. 466.

- LOTTER (G.). — Die Entwicklung der Dampflokomotive in baulicher Beziehung im Spiegel der ersten 18 Jahrgänge des Organs 1846 bis 1863. (7 200 Wörter & Abb.)

Zeitschrift des Vereines Deutscher Ingenieure. (Berlin.)

- 1936** **62. (01 & 669 .1)**
Zeitschr. des Ver. deutsch. Ing., Nr. 47, 21. November, S. 1424.

- HEMPEL. — Dauerfestigkeit von Stählen bei verschiedenen Zug-Mittelspannungen und Prüfstabformen. (800 Wörter & Abb.)

- 1936** **62.** (01)
Zeitschr. des Ver. deutsch. Ing., Nr. 48, 28. November, S. 1433.
- OSCHATZ (H.). — Prüfmaschinen zur Ermittlung der Dauerfestigkeit. (6 600 Wörter & Abb.)
- 1936** **62.** (01)
Zeitschr. des Ver. deutsch. Ing., Nr. 48, 28. November, S. 1440.
- KOCH (W.) & ZELLER (W.). — Schwingungsmessverfahren und ihre Anwendung in der Praxis. (5 400 Wörter & Abb.)
- 1936** **621** .43
Zeitschr. des Ver. deutsch. Ing., Nr. 48, 28. November, S. 1447.
- MEURER (S.). — Indikatoren für schnelllaufende Verbrennungsmotoren. (6 000 Wörter & Abb.)
- 1936** **669**
Zeitschr. des Ver. deutsch. Ing., Nr. 48, 28. November, S. 1466.
- SCHIEL (E.). — Entwicklung der Messverfahren in der Metallkunde. (3 000 Wörter & Abb.)
- Zeitschrift für das gesamte Eisenbahn-Sicherungswesen. (Berlin.)**
- 1936** **625** .151 (.43)
Zeit. für das ges. Eisenb.-Sicherungsw., Nr. 15, 20. November, S. 173.
- HERWIG & BUDDENBERG. — Die Reichsbahnweichen. (1 500 Wörter & Abb.)
- Zeitung des Vereins mitteleuropäischer Eisenbahnverwaltungen. (Berlin.)**
- 1936** **656** (.494)
Zeitung des Ver. mitteleurop. Eisenbahnverw., Nr. 46, 12. November, S. 917.
- WANNER (F.). — Der Entwurf Pilet für eine neue schweizerische Ordnung des Transportes auf Schiene und Strasse. (2 300 Wörter.)
- 1936** **385** .15 (.485)
Zeitung des Ver. mitteleurop. Eisenbahnverw., Nr. 47, 19. November, S. 932.
- PASZKOWSKI (F.). — Die schwedischen Privatbahnen und der Staatsbahngedanke in Schweden. (7 200 Wörter & Abb.)
- 1936** **625** .244
Zeitung des Ver. mitteleurop. Eisenbahnverw., Nr. 48, 26. November, S. 955.
- TASCHINGER (O.). — Neuzeitliche Probleme des Kühlwagenbaus. (5 400 Wörter & Abb.)
- 1936** **385** (.73)
Zeitung des Ver. mitteleurop. Eisenbahnverw., Nr. 48, 26. November, S. 962.
- Die Eisenbahnen der Vereinigten Staaten von Amerika im Jahre 1935. (5 700 Wörter.)

In English.

Bulletin, American Railway Engineering Association. (Chicago, Ill.)

- 1936** **656** .211.7
Bull. American Ry. Engineering Assn., July, p. 1.
- TRATMAN (E. E. R.). — Railway car-ferris: American and foreign. (30 000 words & fig.)
- 1936** **347** .763 (.73) & **625** .162 (.73)
Bull., Amer. Ry. Engineering Assn., July, p. 57.
- Summary of state laws and regulations regarding buses and trucks. — Number of grade crossings and accidents according to type of protection; comparative cost of grade crossing protection for one, two and four tracks, twenty-four hours per day; advantages and disadvantages of different types of grade crossing protection. (Tables.)
- 1936** **621** .13 (.73), **621** .33 (.73) & **621** .43 (.73)
Bull., Amer. Ry. Engineering Assn., August, p. 5.
- Report of Committee I. — **Power supply.** (1) Steam power, water power, internal combustion engine supply. — (2) Servicing equipment along right-of-way for air-conditioning and precooling of cars. — (3) Electrical features of power supply for air-conditioned cars. (2 600 words & 1 table.)
- 1936** **621** .33 (.73)
Bull., Amer. Ry. Engineering Assn., August, p. 13.
- Report of Committee II. — **Electrolysis.** — Study of leakage of stray current through foundations of catenary supporting structures. — Study of the elimination of the effects of electrolysis by the use of non-metallic sheathed cables and life of non-metallic sheathed cables in service. (2 500 words.)
- 1936** **621** .336 (.73)
Bull., Amer. Ry. Engineering Assn., August, p. 18.
- Report of Committee III. — **Overhead transmission line and catenary construction.** — Specifications for bronze and copper trolley wire. — Comprehensive wire tables. (2 000 words, 2 tables.)
- 1936** **621** .39 (.73) & **65.** (.73)
Bull., Amer. Ry. Engineering Assn., August, p. 24.
- Report of Committee IV. — **Standardization of electrical apparatus and materials.** List of standards issued.
- 1936** **621** .39 (.73)
Bull., Amer. Ry. Engineering Assn., August, p. 29.
- Report of Committee V. — **Electric heating and welding.** Thawing frozen pipes electrically. — Electric welding equipment. — Welding manganese steel by electric arc process. (3 700 words & fig.)
- 1936** **621** .31 (.73) & **621** .39 (.73)
Bull., Amer. Ry. Engineering Assn., August, p. 40.
- Report of Committee VI. — **Application of motors.** — New developments in the motor field. — Motor control. (4 600 words & fig.)

1936 **621 .336 (.73) & 625 .111 (.73)**
 Bull., Amer. Ry. Engineering Assn., August, p. 52.
 Report of Committee VII. — **Clearances for third rail and overhead working conductors.** (900 words & fig.)

1936 **614 .8 (.73)**
 Bull., Amer. Ry. Engineering Assn., August, p. 55.
 Report of Committee VIII. — **Protective devices and safety rules in electrified territory.** (2 000 words.)

1936 **621 .39 (.73) & 625 .235 (.73)**
 Bull., Amer. Ry. Engineering Assn., August, p. 61.
 Report of Committee X. — **Illumination.** — Car lighting. — Specifications for large incandescent electric lamps. (5 000 words.)

1936 **621 .331 (.73)**
 Bull., Amer. Ry. Engineering Assn., August, p. 77.
 Report of Committee XI. — **Design of indoor and outdoor substations.** (1 500 words & tables.)

1936 **621 .332 (.73)**
 Bull., Amer. Ry. Engineering Assn., August, p. 81.
 Report of Committee XII. — **High tension cables.** (2 500 words.)

1936 **62. (01 (.73) & 621 .3 (.73)**
 Bull., Amer. Ry. Engineering Assn., August, p. 87.
 Report of Committee XIII. — **Application of corrosion-resisting material to railroad electrical construction.** (1 800 words & fig.)

1936 **016. 621 .33**
 Bull., Amer. Ry. Engineering Assn., August, p. 111.
Applications of electricity to railways. July 1935-June 1936. Bibliography of periodical articles appearing in a select list of periodicals covering the period July 1935 to June 1936, prepared by Edmund Arthur FREEMAN, cataloger, under the direction of the Librarian, Bureau of Railway Economics Library, Washington, D. C.

Engineer. (London.)

1936 **621 .83**
 Engineer, No. 4215, October 23, p. 424; No. 4216, October 30, p. 450; No. 4217, November 6, p. 480; No. 4218, November 13, p. 508.
 MERRITT (H. E.). — **The art of gear design.** (12 600 words & fig.) (To be continued.)

1936 **621 .43 (064 (.42)**
 Engineer, No. 4215, October 23, p. 427; No. 4216, October 30, p. 458.
The International Motor Exhibition. (3 300 words & fig.)

1936 **621 .13 (093**
 Engineer, No. 4215, October 23, p. 444.
Newcomen and the steam engine. (2 000 words.)

1936 **621 .392 & 665 .882**
 Engineer, No. 4215, October 23, Suppl. p. I.
 BONDY (O.). — **Achievements and prospects of welding.** (3 900 words & fig.)

1936 **621 .392**
 Engineer, No. 4215, October 23, Suppl. p. VII.
Electrical arc welding and resistance welding. (16 000 words.)

1936 **621 .392 & 665 .882**
 Engineer, No. 4215, October 23, Suppl. p. XX.
Welded structures and products. (5 000 words & fig.)

1936 **621 .13 (0**
 Engineer, No. 4216, October 30, p. 452.
 The Institution of Mechanical Engineers. Address by the President Sir H. Nigel GRESLEY, C. B. E., D. Sc. **The development of the locomotive.** (4 900 words & 3 tables.)

1936 **385. (072**
 Engineer, No. 4216, October 30, p. 459.
 The new **research laboratory** of the Mond Nickel Company. (1 400 words & fig.)

1936 **621 .39 (.42) & 624 .8 (.42)**
 Engineer, No. 4216, October 30, p. 466.
Electric control of the Kincardine-on-Forth bridge. (2 600 words & fig.)

1936 **621. (∞)**
 Engineer, No. 4216, October 30, p. 470.

The Third World Power Conference. No. IV. — Electric and gas utilities. — Utilisation of water resources. — Rural electrification. — Rationalisation of distribution of electric energy and of gas. — Utilisation of small water powers. — National power policies (4 200 words.)

1936 **669 .1 (06 (.42)**
 Engineer, No. 4217, November 6, p. 486.

The Iron and Steel Institute. No. I. — Blast-furnace coke. — Grain size in steel. — Blast-furnace slags. — Non-metallic inclusions in cast iron. (4 700 words.) (To be continued.)

1936 **691. (.73)**
 Engineer, No. 4218, November 13, p. 510.
Hollow glass blocks as building material. (1 600 words & fig.)

1936 **669 .1 (06 (.42)**
 Engineer, No. 4218, November 13, p. 515.

The Iron and Steel Institute. No. II. — Determination of non-metallic inclusions. — Rolls for cold reduction. (2 300 words & fig.)

1936 **621 .33 (.42**
 Engineer, No. 4218, November 13, p. 527.
Electrification of the Manchester-Sheffield-Watlington. (600 words.)

- 1936** **62. (01**
The Metallurgist, p. 162, Suppl. to the Engineer, October 30.
- DEARDEN (W. H.). — Grinding and polishing for micrography.** (1 600 words.)
-
- 1936** **62. (01 & 669**
The Metallurgist, p. 164, Suppl. to the Engineer, October 30.
- The wear of metals under sliding friction. (1 500 words, 1 table & fig.)
-
- 1936** **669**
The Metallurgist, p. 165, Suppl. to the Engineer, October 30.
- NORTHCOTT (L.). — Veining and the mosaic structure in metals.** (1 700 words.)
-
- 1936** **669 .1**
The Metallurgist, p. 167, Suppl. to the Engineer, October 30.
- The effect of annealing on the length of cold-drawn rods. (600 words.)
-
- 1936** **669 .3 & 669 .6**
The Metallurgist, p. 167, Suppl. to the Engineer, October 30.
- Equilibrium at relatively low temperatures in copper-n alloys. (2 200 words & fig.)
-
- 1936** **669 .1**
The Metallurgist, p. 171, Suppl. to the Engineer, October 30.
- JONES (J. A.). — The quench-ageing of commercial mild steel.** (2 700 words & 3 tables.)
-
- 1936** **669 .1**
The Metallurgist, p. 174, Suppl. to the Engineer, October 30.
- A scale for the estimation of slag inclusions. (2 100 words.)
-
- Engineering. (London.)**
-
- 1936** **624 .7 (.42)**
Engineering, No. 3693, October 23, p. 435.
- The Kincardine-on-Forth road bridge. (3 800 words fig.) (To be continued.)
-
- 1936** **621 .334 (.73)**
Engineering, No. 3693, October 23, p. 444.
- Battery-driven transporting and stacking truck. (1 100 words & fig.)
-
- 1936** **662**
Engineering, No. 3693, October 23, p. 450.
- Fuel for transport. (1 500 words.)
-
- 1936** **385. (074 (.42)**
Engineering, No. 3694, October 30, p. 472.
- Research laboratory of Messrs. The Mond Nickel Company, Ltd., at Birmingham. (3 100 words & fig.)

- 1936** **621 .13 (0**
Engineering, No. 3694, October 30, p. 477.
- The modern steam locomotive. (1 800 words.)
-
- 1936** **669 .1**
Engineering, No. 3694, October 30, p. 488.
- SWINDEN (T.) & BOLSOVER (G. R.). — Controlled grain size in steel.** (Paper read before the Iron and Steel Institute at Düsseldorf, September 22, 1936.) (3 700 words.) (Abridged.)
-
- 1936** **621. (06 (.42) & 621 .13 (0**
Engineering, No. 3694, October 30, p. 489; No. 3696, November 13, p. 541.
- The Institution of Mechanical Engineers. — Address by the President, Sir H. Nigel GRESLEY, C. B. E., D. Sc. (4 800 words & 3 tables.)
-
- 1936** **624 .32 (.485)**
Engineering, No. 3695, November 6, p. 493.
- Road bridge over the Mälar lake at Stockholm. (1 800 words & fig.)
-
- 1936** **669 .1 (.42)**
Engineering, No. 3695, November 6, p. 511.
- The Iron and Steel Institute. (2 300 words.)
-
- 1936** **388. (.42)**
Engineering, No. 3695, November 6, p. 512.
- The work of the London Passenger Transport Board. (1 000 words.)
-
- 1936** **625. (.06 (.42)**
Engineering, No. 3695, November 6, p. 513.
- The Institution of Civil Engineers. (3 000 words.) (To be continued.)
-
- 1936** **624 (.73)**
Engineering, No. 3696, November 13, p. 519.
- The Triborough bridge development, New York. (3 400 words & fig.)
-
- 1936** **53. (06 (.42)**
Engineering, No. 3696, November 13, p. 523.
- The National Physical Laboratory. — Radiology. X-ray analysis of metals and paint materials. — Acoustics. Measurement and abatement of noise. (4 500 words & fig.)
-
- 1936** **669 .1**
Engineering, No. 3696, November 13, p. 527.
- Research on cast iron. (1 100 words.)
-
- 1936** **621 .94 (.42)**
Engineering, No. 3696, November 13, p. 541.
- Copper stay-bolt lathe. (1 200 words & fig.)
-
- Engineering News-Record. (New York.)**
-
- 1936** **624 .51 (.73)**
Engineering News-Record, No. 16, October 8, p. 497.
- PAINE (C. E.). — Designing bridge towers 700-ft. high. (8 300 words & fig.)

1936 **721 .5**
Engineering News-Record, No. 16, October 8, p. 508.

DECK (L.). — Roof repairs with cotton sheeting. (1 200 words & fig.)

1936 **62. (01 & 694**
Engineering News-Record, No. 17, October 15, p. 534.

Plate girders of plywood tested to failure. (500 words & fig.)

1936 **62. (01 & 693**
Engineering News-Record, No. 17, October 15, p. 541.

BLANCHETTE (W. A.). — Compressive and flexural strength of concrete compared. (500 words & fig.)

1936 **624 .9 (.73)**
Engineering News-Record, No. 17, October 15, p. 542.

Long span steel arches incorporate Sawtooth roof. (1 500 words & fig.)

1936 **624 .32 (.439)**
Engineering News-Record, No. 17, October 15, p. 545.

EHASZ (F. L.). — Shallow continuous trusses for Budapest bridge. (800 words & fig.)

1936 **627 (.71)**
Engineering News-Record, No. 18, October 22, p. 569.

Precast concrete cylinders support new wharf. (3 600 words & fig.)

1936 **625. (06 (.73)**
Engineering News-Record, No. 18, October 22, p. 584;
No. 19, October 29, p. 606.

Structural alloys and river control discussed at Pittsburgh. (12 100 words.)

1936 **624 (.485)**
Engineering News-Record, No. 19, October 29, p. 606.

Long steel arches erected by falsework elevator. (1 700 words & fig.)

1936 **624 .4 (.73)**
Engineering News-Record, No. 20, November 5, p. 637.

Cellular concrete bridges being built in Washington. (1 600 words & fig.)

1936 **627 (.44) & 656 .213 (.44)**
Engineering News-Record, No. 20, November 5, p. 638.

Harbor improvements at Dunkerque. (2 500 words & fig.)

Journal, Institute of Transport. (London.)

1936 **385 .22 (.42)**
Journal, Institute of Transport, November, p. 7.

READ (Sir Alfred). — Coastal shipping in relation to transport planning, with some observations on the trends of transport. (12 000 words.)

1936 **385 .1 (.42)**
Journal, Institute of Transport, November, p. 21.

WOOD (W. V.). — Some aspects of railway finance. (5 000 words & fig.)

Journal, Western Society of Engineers. (Chicago)

1936
Journal, Western Soc. of Engineers, August, p. 187.

PHILLIPS (G. P.). — Selection and application of cast metals to machine construction. (8 200 words & 5 tables & fig.)

1936 **721**
Journal, Western Soc. of Engineers, August, p. 209.

GOODER (S. M.). — Underpinning and shoring of structures. (5 500 words & fig.)

Mechanical Engineering. (New York.)

1936 **621 .165 (0**
Mechanical Engineering, November, p. 683.

The steam turbine in the United States. I. — Developments by the Westinghouse Machine Company. (13 500 words & fig.)

1936 **621 .331 (.73**
Mechanical Engineering, November, p. 697.

DORNBROOK (F. L.). — The port of Washington plant. Unique design features and operating experiences. (4 900 words & fig.)

1936 **613 & 62**
Mechanical Engineering, November, p. 713.

ABBOTT (E. J.). — Quieting machinery. (8 300 words & fig.)

1936 **621**
Mechanical Engineering, November, p. 725.

ST. CLAIR (L. J.). — Maintenance and use of cemented carbide tools. (2 200 words & fig.)

1936 **53**
Mechanical Engineering, November, p. 729.

JAKOB (M.). — Heat transfer in evaporation and condensation. — II. (9 300 words & fig.)

Modern Transport. (London.)

1936 **621 .132.3 (.42) & 656 .222.1 (.42)**
Modern Transport, No. 919, October 24, p. 3.

Eight-coupled express locomotive work. L. N. E. I. « Cock o' the North » class. (3 600 words, table & fig.)

1936 **621 .132.5 (.66**
Modern Transport, No. 919, October 24, p. 5.

New locomotives for Gold Coast Railway. British built 4-8-2 type units for mixed traffic working. (1 300 words & fig.)

1936 **313 : 656 .1 (.42**
Modern Transport, No. 919, October 24, p. 6.

KIRKUS (A. E.). — Road transport statistics. A index to present conditions. (900 words & tables.)

- 1936** **656 .1 (.42)**
Modern Transport, No. 919, October 24, p. 7.
Long-distance haulage by road. Metropolitan traffic Commissioner discusses railway competition. (2 800 words.)
-
- 1936** **665 .882 (.42)**
Modern Transport, No. 919, October 24, p. 9.
Oxy-acetylene welding on rails. (650 words.)
-
- 1936** **347 .763 (.42) & 656. (.42)**
Modern Transport, No. 920, October 31, p. 3.
CADBURY (G.). — Transport control and organisation. — Views of a trader. (2 200 words.)
-
- 1936** **624 .7 (.42)**
Modern Transport, No. 920, October 31, p. 5.
New road bridge over the Forth at Kincardine. (2 100 words & fig.)
-
- 1936** **621 .1 (06 (.42) & 621 .13 (0**
Modern Transport, No. 920, October 31, p. 7.
Working results of the « Silver Jubilee ». Sir Nigel Gresley's successful experiment. (2 000 words & 1 table.)
-
- 1936** **625 .246 (.42)**
Modern Transport, No. 920, October 31, p. 9.
20-ton hopper ballast wagons for London Passenger Transport Board for work on underground lines. (500 words & fig.)
-
- 1936** **656. (.41)**
Modern Transport, No. 921, November 7, p. 3.
Railways and roads in Northern Ireland. (4 300 words.)
-
- 1936** **385 .11 (.42) & 388 (.42)**
Modern Transport, No. 921, November 7, p. 6.
London Transport Board's third year. (2 100 words.)
-
- 1936** **621 .43 (.41)**
Modern Transport, No. 921, November 7, p. 7.
Diesel shunting engine for Northern Ireland. (900 words & fig.)
-
- 1936** **656. (.42)**
Modern Transport, No. 922, November 14, p. 5.
DAVIES (A.) & BALLANTYNE (J.). — Transport north of the Border. — Road, rail, sea and air co-ordination. (2 300 words & fig.)
-
- 1936** **385. (071 (.42)**
Modern Transport, No. 922, November 14, p. 7.
A residential staff college for practical training. (1 000 words & fig.)
-
- 1936** **621 .43**
Modern Transport, No. 922, November 14, p. 8.
HORNBuckle (T.). — Diesels for rail traction. — Problems requiring consideration. (2 200 words.)

- 1936** **656 .253 (.42)**
Modern Transport, No. 922, November 14, p. 9.
Increased track capacity on the Southern Railway. No. 3. — Introduction of colour light signalling between Waterloo and Vauxhall. — The new signal box at Waterloo Station. (2 500 words & fig.)
-
- 1936** **656 .1 (.42)**
Modern Transport, No. 922, November 14, p. 11.
MILLS (G.). — Railway-operated road transport. L. N. E. R. arrangements in Scotland. (1 800 words & fig.)
-
- 1936** **621 .33 (.42)**
Modern Transport, No. 922, November 14, p. 12.
COX (E. C.). — Electrification on the Southern Railway. — Profitable traffic increases. (2 000 words.)

Oil Engine. (London.)

- 1936** **621 .43 (.81)**
Oil Engine, September, p. 130.
Two streamlined luxury trains for Brazil. (500 words & fig.)
-
- 1936** **621 .43**
Oil Engine, September, p. 139.
INGHAM (E.). — The maintenance of oil engine valves. (1 100 words.)
-
- 1936** **621 .132.6 (.73) & 621 .43 (.47)**
Oil Engine, September, p. 141.
The largest single-engined Diesel locomotive. (1 100 words & fig.)

Proceedings, American Society of Civil Engineers. (New York.)

- 1936** **62. (01, 669 & 721 .9**
Proceed., Amer. Soc. of Civil Engineers, October, p. 1125.
I. — Modern stress theories and fatigue research: Modern stress theories, by A. V. KARPOV. — Tests of engineering structures and their models, by R. L. TEMPLIN. — Photo-elastic determination of stress, by J. H. A. BRATHZ. (33 000 words & fig.)
-
- 1936** **669 & 721 .9**
Proceed., Amer. Soc. of Civil Engineers, October, p. 1183.
II. — Metallurgical and manufacturing aspects of ferrous and light-weight alloys of interest in structural design and fabrication: Low-alloy structural steels, by E. C. BAM & F. T. LLEWELLYN. — Stainless, high-alloy structural steels, by M. J. R. MORRIS. — Corrosion in relation to engineering structures, by J. ASTON. (34 000 words & fig.)
-
- 1936** **669 & 721 .9**
Proceed., Amer. Soc. of Civil Engineers, October, p. 1283.
III. — Structural applications of special steels: Actual applications of special structural steels, by V. D. BEARD. — Evolution of high-strength steels used in structural engineering by L. S. MOISSEIFF. (25 000 words, tables & fig.)

- 1936** **669 & 721 .9**
 Proceed., Amer. Soc. of Civil Engineers, October, p. 1303.
 IV. — **Light-weight structural designs :**
 The application of stainless steel in light-weight construction, by E. J. W. RAGSDALE. — Structural application of aluminium alloys, by E. C. HARTMANN. — Magnesium alloys and their structural application, by A. W. WINSTON. (17 000 words & fig.)

Railway Age. (New York.)

- 1936** **625 .162 (.73) & 656 .212 (.73)**
 Railway Age, No. 15, October 10, p. 504.
 New York Central completes grade separation and passenger station project within City of Syracuse. (7 200 words & fig.)
- 1936** **621 .132.3 (.42)**
 Railway Age, No. 15, October 10, p. 514.
 Three-cylinder locomotive on the London & North Eastern. (1 400 words & fig.)
- 1936** **614 .8 (06 (.73))**
 Railway Age, No. 15, October 10, p. 521.
 Steam Railroad Session at National Safety Council Meeting. (5 500 words.)
- 1936** **621 .132.3 (.73) & 625 .232 (.73)**
 Railway Age, No. 16, October 17, p. 548.
 New equipment for the Hiawatha. (3 000 words & fig.)
- 1936** **656 .213 (.73)**
 Railway Age, No. 16, October 17, p. 555.
 Chesapeake & Ohio builds third modern coal dumper at Toledo, Ohio. (4 000 words & fig.)
- 1936** **625 .27 (.73)**
 Railway Age, No. 16, October 17, p. 563.
 REASONER (Ch. E.). — Profit and loss in scrap handling operations. (1 500 words & fig.)
- 1936** **621 .132.8 (.73) & 625 .232 (.73)**
 Railway Age, No. 17, October 24, p. 581.
 New Haven two-car train with Besler steam power plant. (4 600 words, fig. & 1 table.)
- 1936** **725 .33 (.73)**
 Railway Age, No. 17, October 24, p. 586.
 TURNER (F. P.). — Water supply a large factor in economical train operation. (3 600 words & fig.)
- 1936** **656 .261 (.73)**
 Railway Age, No. 17, October 24, p. 597.
 Co-ordinated service attracts merchandise traffic. (2 800 words & fig.)
- 1936** **621 .132.7 (.73) & 621 .43 (.73)**
 Railway Age, No. 18, October 31, p. 615.
 New Haven's ten switchers involve unusual considerations. (6 000 words & fig.)

- 1936** **385 .21 (.73)**
 Railway Age, No. 18, October 31, p. 622.
 RIGGS (H. E.). — The Fort Peck dam and navigation (4 600 words, 1 table & fig.)
- 1936** **621 .43 (.73) & 656 .222.1 (.73)**
 Railway Age, No. 18, October 31, p. 627.
 Denver Zephyr breaks world speed records. (1 300 words & fig.)
- 1936** **656 .225 (.73) & 656 .23 (.73)**
 Railway Age, No. 18, October 31, p. 628.
 Investigation of freight forwarding. (4 700 words)
- 1936** **621 .43 (.73) & 625 .232 (.73)**
 Railway Age, No. 19, November 7, p. 658.
 Denver Zephyrs ready for overnight Chicago service (5 600 words & fig.)
- 1936** **621 .43 (.73)**
 Railway Age, No. 19, November 7, p. 669.
 Denver Zephyrs hauled by 3 000-h.p. Diesel locomotives. (1 800 words & fig.)
- 1936** **385 .3 (.73) & 656 .261 (.73)**
 Railway Age, No. 19, November 7, p. 671.
 Interstate Commerce Commission approves C. & D. in East. (5 400 words.)
- 1936** **621 .39 (.73) & 625 .1 (06 (.73))**
 Railway Age, No. 19, November 7, p. 675.
 Electrical men (A. R. E. E.) meet in Joint Session (Abstracts of reports, and discussions.) (9 000 words.)
- 1936** **624. (06 (.73))**
 Railway Age, No. 19, November 7, p. 683.
 Bridge and Building men convene at Chicago. (5 800 words.)
- Railway Engineering and Maintenance:**
(Chicago.)
- 1936** **385 .56 (.71) & 625 .17 (.71)**
 Railway Engineering & Maintenance, November, p. 695.
 Unemployed workers make good on railway jobs in Canada. (3 900 words & fig.)
- 1936** **625 .173 (.73)**
 Railway Engineering & Maintenance, November, p. 697.
 BRONSON (C. B.). — Rail maintenance. — The Roadmasters' problem. — (Address presented before the convention of the Roadmasters and Maintenance of W. Association on September 16, 1936.) (4 500 words.)
- 1936** **624. (06 (.73))**
 Railway Engineering & Maintenance, November, p. 701.
 Bridge men discuss problems at annual meeting
 Relative merits of different species of wood for timber bridges. Adapting bridge maintenance methods to today's requirements for high-speed train service. — Recent developments in preframing timber bridges. — Under-water repairs to bridge piers and abutments. — Maintenance of railway roofs. — Protecting steel bridges against brine drippings. — Our bridge and building organization to meet the demands of the recovery period. — The inspection and maintenance of water tanks (45 000 words & fig.)

Railway Gazette. (London.)

- 1936** **621 .132.3 (.43) & 621 .132.8 (.43)**
Railway Gazette, No. 17, October 23, p. 657.
Novel Henschel locomotive designs. (900 words & fig.)
-
- 1936** **656 .211.6 (.42)**
Railway Gazette, No. 17, October 23, p. 663.
London's new inter-station buses. (950 words & fig.)
-
- 1936** **656 .1 (.68)**
Railway Gazette, No. 17, October 23, p. 665.
Railway road motor services in South Africa. (1 700 words & fig.)
-
- 1936** **656 .23 (.42)**
Railway Gazette, No. 18, October 30, p. 697.
British railways freight traffic, 1929-1935. (600 words & fig.)
-
- 1936** **656 .253 (.494)**
Railway Gazette, No. 18, October 30, p. 702.
Colour-light signals on the Swiss Railways. (400 words & fig.)
-
- 1936** **621 .138.5 (.42) & 669 .1 (.42)**
Railway Gazette, No. 18, October 30, p. 705.
New steel melting furnaces at Crewe works, L. M. S. R. (600 words & fig.)
-
- 1936** **621. (.06 (.42) & 621 .13 (0 (.42)**
Railway Gazette, No. 18, October 30, p. 712.
Sir Nigel Gresley on the « Silver Jubilee ». — Efficiency of streamlining discussed in presidential address to the Institution of Mechanical Engineers. (1 300 words.)
-
- 1936** **625 .111 (.42)**
Railway Gazette, No. 19, November 6, p. 749; No. 20, November 13, p. 786.
BARTER (S.). — Flying and burrowing junctions on the Southern Railway. (3 400 words & fig.)
-
- 1936** **385. (09.1 (.41)**
Railway Gazette, No. 19, November 6, p. 752; No. 20, November 13, p. 789.
The Irish international main line. (8 700 words & fig.)
-
- 1936** **621 .132.6 (.73)**
Railway Gazette, No. 19, November 6, p. 759.
New 0-6-0 type U. S. A. shunting locomotives. (350 words & fig.)
-
- 1936** **656 .25**
Railway Gazette, No. 19, November 6, p. 764.
Railway safety. (1 700 words.)
-
- 1936** **625 .258 (.42)**
Railway Gazette, No. 20, November 13, p. 795.
Power signalling at Waterloo. (1 000 words & fig.)

- 1936** **656 .222.1 (.42)**
Railway Gazette, No. 20, November 13, p. 805.
Locomotive working on the Silver Jubilee. (800 words & 1 table.)
-
- 1936** **621 .43 (.44)**
Diesel Ry. Traction, p. 724, Supplt. to Ry. Gazette, October 30.
A new French double-bogie railcar. (2 700 words, tables & fig.)
-
- 1936** **621 .43**
Diesel Ry. Traction, p. 730, Supplt. to Ry. Gazette, October 30.
Remote control for mechanical transmission. (1 300 words & fig.)
-
- 1936** **625 .232 (.45)**
Diesel Ry. Traction, p. 732, Supplt. to Ry. Gazette, October 30.
Express buffet cars for Italy. Double engine design for main lines. (1 000 words & fig.)
-
- 1936** **621 .43 (.492)**
Diesel Ry. Traction, p. 735, Supplt. to Ry. Gazette, October 30.
The Dutch diesel trains. (900 words & fig.)
-
- 1936** **621 .43 (.44)**
Diesel Ry. Traction, p. 737, Supplt. to Ry. Gazette, October 30.
High-power single-unit cars for mountain service. (1 200 words & fig.)
-
- 1936**
Diesel Ry. Traction, p. 738, Supplt. to Ry. Gazette, October 30.
First diesel railcar in Rhodesia. (700 words & fig.)
-
- 1936** **621 .33 (.42)**
Electric Ry. Traction, p. 824, Supplt. to Ry. Gazette, November 13.
Manchester-Sheffield electrification. — Details of L. N. E. R. conversion. (1 500 words & fig.)
-
- 1936** **621 .33 (.42)**
Electric Ry. Traction, p. 828, Supplt. to Ry. Gazette, November 13.
COX (E. C.). — Progress of the Southern Railway electrification. (2 700 words & fig.)
-
- Railway Magazine. (London.)**
- 1936** **656 .222.1 (.4)**
Railway Magazine, November, p. 316.
European express trains in the Summer of 1936. — I. (1 900 words & tables.) (To be continued.)
-
- 1936** **656 .222.1 (.42)**
Railway Magazine, November, p. 322.
ALLEN (C. J.). — British locomotive practice and performance. (4 200 words & fig.)

1936 **656 .211.7 (.42 + .44)**
 Railway Magazine, November, p. 353.
 The through sleeping car service between London and Paris. (700 words & fig.)

Railway Mechanical Engineer. (Philadelphia.)

1936 **621 .132.5 (.73)**
 Railway Mechanical Engineer, October, p. 421.
 Large boiler and roller bearings feature Norfolk & Western locomotives. (700 words & fig.)

1936 **621 .134.2**
 Railway Mechanical Engineer, October, p. 427.
 SMITH (J. E.). — Link motion valve gear. (1 200 words & fig.)

1936 **621 .13 (0 & 656 .284)**
 Railway Mechanical Engineer, October, p. 429.
 WILLIAMS (F. H.). — Failures of locomotive parts. (2 500 words & fig.)

1936 **62. (01 & 625 .242)**
 Railway Mechanical Engineer, October, p. 434.
 SCHRAMM (G. N.), TAYLERSON (E. S.) & LARRA-BEE (C. P.). — Corrosion of open-top cars. (4 400 words & fig.)

1936 **625 .26 (.73)**
 Railway Mechanical Engineer, October, p. 453.
 Car work at Havelock shops. (1 800 words & fig.)

Railway Signaling. (Chicago.)

1936 **656 .259 (.73)**
 Railway Signaling, November, p. 567.
 Pennsylvania installs devices (cast-iron arms mounted slightly below rail level) to detect dragging equipment. (2 300 words & fig.)

1936 **656 .259 (.73)**
 Railway Signaling, November, p. 569.
 Drag detectors on the Lackawanna. (700 words & fig.)

1936 **656 .253 (.73)**
 Railway Signaling, November, p. 571.
 BAIRD (M. A.). — Approach electric lighting on the Erie. (650 words & fig.)

1936 **656 .257 (.73)**
 Railway Signaling, November, p. 572.
 Interlocking and remote control on Erie. (3 500 words & fig.)

1936 **656 .258 (.73)**
 Railway Signaling, November, p. 579.
 All-relay interlocking on N. Y. C. at Syracuse. (5 000 words & fig.)

1936 **656 .254 (06 (.73)**
 Railway Signaling, November, p. 586.
 Telegraph and Telephone Section, A. A. R., annual convention. — (Carrier systems, teletype and amateur radio stations discussed at three-day meeting at Washington, D. C.) (2 500 words.)

1936 **656 .254 (.73)**
 Railway Signaling, November, p. 588.
 Automatic telephones save steps on drug display train. (700 words & fig.)

South African Railways and Harbours Magazine (Johannesburg.)

1936 **625 .142 (.68)**
 South African Railways & Harbours Magazine, October p. 1309.
 HURRY (L. G.). — Sleeper supplies for the South African Railways. (2 200 words.)

In Dutch.

De Ingenieur. (Den Haag.)

1936 **656 (.92)**
 De Ingenieur, n° 47, 20 November, p. V. 113.
 DE JONGH (D.). — Regeling van het verkeer te land in Nederlandsch Indië. (9 600 woorden.)

1936 **625 .144.**
 De Ingenieur, n° 47, 20 November, p. V. 121.
 Raillengten. — (2 100 woorden & fig.)

Spoor- en Tramwegen. (Utrecht.)

1936 **385 (.492)**
 Spoor- en Tramwegen, n° 24, 24 November, p. 567.
 REITSMA (J. M. I.). — De naaste vooruitzichten van het Nederlandsche Spoorwegbedrijf. (3 200 woorden & fig.) (Slot volgt.)

1936 **621 .132.1 (.489)**
 Spoor- en Tramwegen, n° 24, 24 November, p. 575.
 van MAANEN (J.). — Deensche stoomtractie. (1 200 woorden & fig.)

MONTHLY BIBLIOGRAPHY OF RAILWAYS ⁽¹⁾.

PUBLISHED UNDER THE SUPERVISION OF

P. GHILAIN,

General Secretary of the Permanent Commission of the International Railway Congress Association.

(FEBRUARY 1937)

[016.385. (02)]

I. — BOOKS.

In French.		
1936	62. (02 & 69. (02	
CLAUDEL (J.).		
Aide-mémoire des ingénieurs, architectes, entrepreneurs, etc.		
Paris, Dunod, 92, rue Bonaparte. 1 volume (13×21), 2.296 pages et 1.604 figures. (Prix : 95 fr. français.)		
1936	621 .392	
SARAZIN (R.).		
La soudure électrique à l'arc.		
Neuilly (Seine), Sarazin, ingénieur-soudeur. 1 volume, 496 pages et figures. (Prix : 40 fr. français.)		
In German.		
1936	621 .43	
DIESELMASCHINEN.		
Berlin, V-D-I Verlag. 1 Band. (Preis : 6 R.M.)		
1936	691	
KORROSION V.		
Berlin, V-D-I-Verlag. I Band, 120 Seiten und Abbildungen. (Preis : 7.50 R.M.)		
1936	665 .882	
MAYER-SIDD (E.) und RUHLAND (J.).		
Merkbuch für Fehler beim Autogen-Schweissen Gasschmelzschweissen) nebst ausführlichen Richtlinien für das Schweissen der verschiedenen Metalle.		
Berlin, Union Deutsche Verlagsgesellschaft. 1 Band. 44 Seiten. Abbildungen und Zahlentafeln. (Preis : 5.50 R.M.)		
1936	621 .392	
SCHWEISSTECHNIK.		
Berlin, V-D-I-Verlag. 1 Band, 67 Seiten mit 275 Abbildungen und 27 Zahlentafeln. (Preis : 4.50 R.M.)		
1936	656 .2	
SOMMERLATTE und MOORMANN.		
Leitfaden für den Verkehrsdienst. Heft II : Abfertigungs- und Abfertigungskassenwesen.		
Berlin, Verkehrswissenschaftlichen Lehrmittelgesellschaft m. b. H. bei der Deutschen Reichsbahn. Dritte Auflage. 1 Band. (Preis : 2 R.M.)		
1936	656 .257	
Lehrstoffheit i 8 : Stellwerks- und Blockanlagen. Heft 3 : Kraftstellwerke.		
Berlin (W. 9). Verkehrswissenschaftliche Lehrmittelgesellschaft m. b. H. bei der Deutschen Reichsbahn. 1 Band, 250 seiten und 62 Abbildungen.		
In English.		
1936	621 .116	
ARMSTRONG (H. C.) & LEWIS (C. V.).		
Boiler management, maintenance and inspection. A handbook for boiler owners and boiler attendants.		
London : Charles Griffin and Company, Limited. (Price : 10 sh. net.)		
1936	385. (02	
A Yearbook of Railroad Information : 1936 edition.		
New-York : published by the Committee on Public Relations of the Eastern Railroads, 143, Liberty street, (6 in. × 4 in.) 96 pp. gratis.		
1936	624. (09	
BLACK (Archibald).		
The story of bridges.		
London Mc Graw-Hill Publishing Company, Limited. (Price : 12 s. 6 d.)		
1936	62. (02	
Handbook of engineering fundamentals.		
Prepared by a staff of specialists under the editorship of Ovid W. Eshbach. Published by John Wiley & Sons, Inc., New-York. 1081 pages. (5 1/2 in. by 8 3/8 in.), illustrated. (Price : 5 \$).		

(1) The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress conjointly with the Office Bibliographique International, of Brussels. (See « Bibliographical Decimal Classification as applied to Railway Science », by L. WEISSENBRUCH, in the number for November 1897, of the *Bulletin of the International Railway Congress*, p. 1509).

1936 **621 .35**
IBBETSON (W. S.).
Accumulator charging, maintenance and repair. (Fifth edition.)
 London : Sir Isaac Pitman, Sons, and Co, Ltd., Parker-street, W. C. 2. (Price : 20 s. net.)

1936 **624. (06**
International association for bridge and structural engineering. Publications. Fourth volume 1936.
 Zurich : Verlag A.-G. Gebr. Leemann & Co. (Price : 30 Swiss francs.)

1936 **385 .114 (.54), 621 .138.5 (.54) & 625 .26 (.54)**
MYER (S. V.).
Cost accounting in English and Indian Railway Workshops.
 Calcutta : East Indian Railway Press. (Price : Annas 5 or 6 d.)

1936 **621. (02**
Kent's Mechanical Engineers' Handbook. Power. Published by John Wiley & Sons, Inc., New York. 1254 pages, illustrated ; 5 5/8 in. by 8 5/8 in.). (Price : \$ 5.)

1936 **669 .3**
KILBURN (W. L.).
Copper and Bronze Welding.
 London : British Oxygen Company, Ltd. Thomas House Millbank, S. W. 1. (Price 5 s. net.)

1936 **624 .2**
PODOLSKY (Jn.).
The universal formula of the elastic line of the beam. Paper ; (5 × 8 in.) ; pp. 152 ; linecuts, tables.
 Published in Russian by the United Scientific and Technical Publishing House of the People's Commissariat of Heavy Industry of the U.S.S.R., Moscow, Russia.

1936 **621 .392**
Procedure handbook of arc welding design and practice. 4th edition. Prepared by the Lincoln Electric Co. Fabricoid ; (5 1/2 × 9 in.) ; pp. 819 ; Half-tones, linecuts, tables. Published by the Lincoln Electric Co. Cleveland, Ohio (Price : \$ 1.50 in U. S. ; \$ 2.00 elsewhere.

1936 **385 .1 (.485)**
Short survey of the developments of the Swedish State Railways, during the period between the General Meetings of the Scandinavian Railwaymen Society in the years 1932 and 1936.
 Address by the Director General A. GRANHOLM at the General Meeting of the Scandinavian Railwaymen Society in July 1936. Stockholm.

1936 **385. (093 & 621 .13 (093**
STEVENS (John).
Documents tending to prove the superior advantages of railways and steam-carriages over canal navigation. A pamphlet of 1812 reprinted under the joint auspices

of the Baker Library, Harvard Graduate School of Business Administration, and the Railway and Locomotive Historical Society.

Boston, Mass. Baker Library, Soldiers Field (9 × 6 inches). Paper covers. (Price : \$ 1.00 net).

1936 **62. (01 (06 (.73) & 66. (06)**
Symposium on high-strength constructional metals. Pittsburgh regional meeting. American Society for testing materials, March 4, 1936.
 Philadelphia, Pa. : American Society for testing materials. (Price : 1 dol. 25 cents.)

1936 **621 .13 (02 (.42**
The Locomotive Engineers' Pocket Book, 1936-37.
 London : The Locomotive Publishing Company, Ltd. 3, Amen Corner, E. C. 4. (Price : 3 s. 6 d. net.)

1936 **385. (091 (∞**
THE RAILWAY GAZETTE.

1936 Annual Overseas Railways Number, containing a series of articles on most of the leading railway systems in Canada, Africa, Australia, New Zealand, India, Ceylon, Argentina, Brazil and other places. A volume (10 × 8 3/4 inches), of 120 pages, profusely illustrated. Published by « The Railway Gazette », London, 33, Tottenham Street, Westminster, S.W. 1 (Price : 2 sh.)

1936 **659 (.67)**
The travellers' Guide to Kenya and Uganda. Nairobi Kenya Colony. Published by the Kenya and Uganda Railways and Harbours. 232 pages, illustrations and a map.

1936 **385 .11 (.73)**
WILLARD (D.).

Extracts from remarks by the President of the Baltimore and Ohio Railroad Company at the 110th Annual Meeting of the stockholders in Baltimore, Md. on November 16, 1936. (6.000 words.)

In Spanish.

1936 **625. (.82)**
Memoria del Ministerio de Obras Públicas (Dirección Nacional de Vialidad de la República Argentina, año 1935. Tomo I. Buenos Aires. Ministerio de Obras Públicas. 1 volumen, 630 páginas y figuras.

1936 **625. (.82)**
Memoria del Ministerio de Obras Públicas (Dirección Nacional de Vialidad) de la República Argentina, año 1935. Tomo II. Buenos Aires. Ministerio de Obras Públicas. 1 volumen, 283 páginas.

In Italian.

1936 **624 .63**
SANTARELLA (L.).

Il comportamento elastico di ponti ferroviari in cemento armato.

Milano, Ulrico Hoepli. 1 volume, 72 pagine e 29 figure. (Prezzo : 10 Lire.)

016. 385. (05]

II. — PERIODICALS.

In French.

Bulletin de la Société d'encouragement pour l'industrie nationale. (Paris.)

1936 **669**
Bull. de la Soc. d'encouragement pour l'ind. nat., octobre-novembre, p. 593.

HOLLARD (A.). — Les **maladies des métaux**. Épidémies et contagions. (4 500 mots & fig.)

1936 **621 .33**
Bull. de la Soc. d'encouragement pour l'ind. nat., octobre-novembre, p. 609.

ERB (A.). — Solutions nouvelles à quelques problèmes de **traction électrique**. (3 500 mots & fig.)

1936 **621 .116**
Bull. de la Soc. d'encouragement pour l'ind. nat., octobre-novembre, p. 631.

BIGEON (J.). — L'**épuration des eaux d'alimentation des chaudières** et l'élimination des tartres par l'emploi des détartrants. (3 400 mots.)

Bulletin de la Société des ingénieurs civils de France. (Paris.)

1936 **621 .13 (09 & 625 .2 (09**
Bull. de la Soc. des ing. civ. de France, fascicule n° 16, p. 325.

LANCRENON. — **Evolution des conditions de traction et du matériel roulant** du fait des progrès généraux de la science. (900 mots.)

1936 **656 .2 (09**
Bull. de la Soc. des ing. civ. de France, fascicule n° 16, p. 327.

LEVI (R.). — **Evolution des installations de la voie et de l'exploitation** du fait des progrès généraux de la science. (1 000 mots.)

Bulletin des transports internationaux par chemins de fer. (Berne.)

1936 **385 .62 & 385 .63**
Bull. des transp. intern. par ch. de fer, décembre, p. 519.
Longueur kilométrique des lignes auxquelles s'appliquent la **C. I. M.** et la **C. I. V.** du 23 octobre 1924. (Art. et 2.) (1 200 mots.)

1936 **385 .62 & 656 .234 (.45)**
Bull. des transp. intern. par ch. de fer, décembre, p. 525.
Le nouveau texte des « **Conditions et tarifs** » italiens relatifs au transport des voyageurs et la **C. I. V.** (3 600 mots.)

1936

313 .385 (.492)

Bull. des transp. intern. par ch. de fer, décembre, p. 556.

Statistique des chemins de fer néerlandais pour les années 1934 et 1935. (800 mots.)

Bulletin technique de la Suisse romande. (Vevey.)

1936 **62. (01 & 669 .1**
Bull. techn. de la Suisse romande, n° 26, 19 décembre, p. 315.

LEMOINE (A.). — Définition et interprétation des caractéristiques des **aciers spéciaux**. (1 200 mots.) (A suivre.)

Chronique des transports. (Paris.)

1936 **656. (.493)**
Chronique des transports, n° 23, 10 décembre, p. 2.

La **coordination** du rail et de la route en Belgique. (2 200 mots.)

1936 **656. (.61)**
Chronique des transports, n° 23, 10 décembre, p. 16.

La **coordination** des transports ferroviaires et routiers en Tunisie. (1 000 mots.)

Electricité. (Paris.)

1936 **656 .254**
Electricité, décembre, p. 434.

La **répétition continue des signaux** sur les locomotives. (2 700 mots & fig.)

Génie civil. (Paris.)

1936 **624 .51 (.73)**
Génie civil, n° 2834, 5 décembre, p. 497.

Le **viaduc** de San Francisco à Oakland, à travers la baie de San Francisco (Californie). (3 200 mots & fig.)

1936 **669 .1**
Génie civil, n° 2834, 5 décembre, p. 511.

La **trempe superficielle** des aciers au chalumeau. (2 300 mots & fig.)

1936 **691**
Génie civil, n° 2835, 12 décembre, p. 533.
LEMAIRE (E.). — La **résistance des ciments artificiels** très siliceux aux eaux sulfatées et à l'eau de mer. (2 300 mots & fig.)

1936 **669**
Génie civil, n. 2836, 19 décembre, p. 559.
Les récents progrès réalisés dans la **métallurgie** de l'aluminium, du cuivre et du zinc. (1 900 mots.)

1936 **385. (09.3)**
Génie civil, n° 2836, 19 décembre, p. 562.
Le centenaire des chemins de fer. (1 500 mots.)

1936 **625 .13 (.44)**
Génie civil, n° 2837, 26 décembre, p. 582.
La reconstruction du pont-rails sur la Mosson, près de Montpellier. (800 mots & fig.)

L'Allègement dans les transports. (Lucerne.)

1936 **625 .234**
L'allègement dans les transports, novembre-décembre, p. 142.

BILEK (J.). — Elektrische Heizung von Triebwagen. Anhängern, beruhend auf einer Abisolierung und regulierbaren Abgabe aufgespeicherter Wärme. (1 700 mots & fig.)

1936 **625 .616 (.460)**
L'allègement dans les transports, novembre-décembre, p. 153.

Matériel roulant léger pour voie étroite. (200 mots & fig.)

1936 **625 .21**
L'allègement dans les transports, novembre-décembre, p. 154.

KREISSIG (E.). — Geschlossene Träger beim Eisenbahnwagenbau. (3 300 mots & fig.) (A suivre.)

La Technique moderne. (Paris.)

1936 **621 .43**
La technique moderne, n° 24, 15 décembre, p. 851.
MERCIER (A.). — Traction Diesel. (1 800 mots.)

Les Chemins de fer et les Tramways. (Paris.)

1936 **621 .132.3 (.71)**
Les Chemins de fer et les Tramways, décembre, p. 196.
LONDRES (E. A.). — Un nouveau type de locomotive des Chemins de fer nationaux canadiens. (1 800 mots & fig.)

1936 **621 .132.8 (.73) & 621 .43 (.73)**
Les Chemins de fer et les Tramways, décembre, p. 198.
Locomotive Diesel-électrique de 2 000 C.V. (1 800 mots & fig.)

1936 **621 .132.8**
Les Chemins de fer et les Tramways, décembre, p. 199.
KEULEYAN (L.). — Automotrice à vapeur chauffée au charbon. (3 100 mots & fig.)

1936 **621 .43 (.73)**
Les Chemins de fer et les Tramways, décembre, p. 202.
Trains Diesel électriques de 2 400 C.V. et 3 000 C.V. (1 300 mots & fig.)

1936 **656 .25**
Les Chemins de fer et les Tramways, décembre, p. 202.
L'éclairage électrique par piles des signaux mécaniques. (2 800 mots & fig.)

1936 **621 .42**
Les Chemins de fer et les Tramways, décembre, p. 202.
Perfectionnement au freinage des automotrices (2 400 mots & fig.)

L'Ossature métallique. (Bruxelles.)

1936 **62. (01 & 621 .39)**
L'Ossature métallique, décembre, p. 569.
SCHONS (V.). — L'examen des soudures à l'aide des rayons « X. » (1 000 mots & fig.)

1936 **624 .1**
L'Ossature métallique, décembre, p. 572.
VIERENDEEL (A.). — Poutre Vierendeel et poutre triangulées. (2 000 mots & fig.)

Revue générale des chemins de fer. (Paris.)

1936 **621 .392 (.44) & 624 .32 (.44)**
Revue Générale des Chemins de fer, décembre, p. 353.
CAMBOURNAC. — Construction à la plaine Saint-Denis, sur le réseau du Nord français, d'un pont sous rails en charpente métallique soudée. (1 800 mots & fig.)

1936 **385 .113 (.44) & 656. (.44)**
Revue Générale des Chemins de fer, décembre, p. 370.
KIPPER. — Les Grands Réseaux de Chemins de fer français en 1935. (12 000 mots, tableaux & fig.)

1936 **385 .113 (.493)**
Revue Générale des Chemins de fer, décembre, p. 399.
CLOSSET (P.). — Les Chemins de fer belges en 1935. (6 000 mots.)

1936 **625 .4 (.43)**
Revue Générale des Chemins de fer, décembre, p. 405.
VINOT. — La ligne Nord-Sud de la Stadtbahn de Berlin. (1 200 mots & fig.)

1936 **625 .215**
Revue Générale des Chemins de fer, décembre, p. 409.
Nouveau type de bogie lourd. (300 mots & fig.)

1936 **621 .135.2**
Revue Générale des Chemins de fer, décembre, p. 410.
Nouveau type de roue de locomotive. (700 mots & fig.)

Revue universelle des Mines. (Liège.)

1936 **624 .2**
Revue universelle des mines, décembre, p. 502.
MARTELEE (J.). — Méthodes de calcul des portiques simples encastrés. (2 400 mots & fig.)

In German.

Die Lokomotive. (Wien.)

1936 **621 .132.1 (.42)**

Die Lokomotive, Dezember, S. 217.

STEFFAN. — Die **neueren Lokomotiven** der London, Midland & Schottischen Eisenbahn. V. (3 200 Wörter & Abb.)

Die Reichsbahn. (Berlin.)

1936 **656 .222.5 (.4)**

Die Reichsbahn, Heft 51. 16. Dezember, S. 1 087.

Die **Europäische Fahrplan- und Wagenbeistellungskonferenz 1936** in Montreux. (7 000 Wörter.)

Elektrische Bahnen. (Berlin.)

1936 **621 .335 & 625 .251**

Elektrische Bahnen, November, S. 278.

KLEINOW (W.). — **Elektrische Schnellzuglokomotiven** für Höchstgeschwindigkeiten mit besonderer Berücksichtigung der Bremsung. (2 400 Wörter.)

1936 **625 .255**

Elektrische Bahnen, November, S. 281.

KNIFFLER (A.). — **Elektrische Bremsen** bei den Oberleitungstriebwagen der Deutschen Reichsbahn. (6 000 Wörter & Abb.)

1936 **621 .335 (.43)**

Elektrische Bahnen, November, S. 289.

HERMLE (H.). — Die **Steuerung der I' Do P - Reichsbahn - Schnellzuglokomotive** Reihe E. 18. (3 800 Wörter & Abb.)

1936 **621 .335 (.43)**

Elektrische Bahnen, November, S. 295.

BALKE (H.). — **Neue Steuerungen für Einheits- — Wechselstrom — Doppeltriebwagen** der Deutschen Reichsbahn. (3 000 Wörter & Abb.)

1936 **621 .33**

Elektrische Bahnen, November, S. 302.

TAUBER (W.). — **Umspanner für elektrische Triebfahrzeuge**. (1 500 Wörter & Abb.)

Glaser's Annalen. (Berlin.)

1936 **621 .135.4**

Glaser's Annalen, Heft 10. 15. November, S. 121.

KINKELDEI (L.). — **Krümmungseinstellung, Führungsdrücke und Krümmungswiderstand von Lokomotiven** mit Drehgestellen, nach dem Druckrollenverfahren berechnet. (4 800 Wörter & Abb.) (Schluss folgt.)

Organ für die Fortschritte des Eisenbahnwesens. (Berlin.)

1936 **625 .22**

Organ für die Fortschr. des Eisenbahnw. Heft 23, 1. Dezember, S. 477.

FEYL (E.). — Die Grundlagen der Bestimmungen für die **Umgrenzung des lichten Raumes**. (6 000 Wörter & Abb.)

1936 **621 .431**

Organ für die Fortschr. des Eisenbahnw. Heft 23, 1. Dezember, S. 488.

MECKEL (A.). — **Begrenzung der Breitenmasse** bei Lokomotiven. (1 900 Wörter & Abb.)

1936 **621 .33 (.3)**

Organ für die Fortschr. des Eisenbahnw. Heft 23, 1. Dezember, S. 491.

Stand des elektrischen Vollbahnbetriebes in der Welt. (2 600 Wörter.)

1936 **625 .22**

Organ für die Fortschr. des Eisenbahnw. Heft 24, 15. Dezember, S. 495.

FEYL (E.). — Die Grundlagen der Bestimmungen für die **Umgrenzung des lichten Raumes**. (5 000 Wörter & 3 Tafeln.)

1936 **621 .135.2 & 625 .212**

Organ für die Fortschr. des Eisenbahnw. Heft 24, 15. Dezember, S. 504.

KÖNIG. — **Zerstörungsfreie Untersuchung von Radsätzen auf Anbrüche**. (2 700 Wörter, 2 Tafeln & Abb.)

1936 **621 .132.8**

Organ für die Fortschr. des Eisenbahnw. Heft 24, 15. Dezember, S. 510.

Anthrazit-Triebwagen. (1 500 Wörter & Abb.)

Zeitschrift des Vereines Deutscher Ingenieure. (Berlin.)

1936 **621 .135.2 & 625 .212**

Zeitschrift des Vereines deutscher Ingenieure, Nr. 49, 5. Dezember, S. 1 475.

BEILFUSS (S.). — **Druck-Giessverfahren für die Herstellung dünner Ausgüsse von Eisenbahn-Fahrzeuglagern**. (1 800 Wörter & Abb.)

1936 **62. (01 & 669)**

Zeitschrift des Vereines deutscher Ingenieure, Nr. 50, 12. Dezember, S. 1 499.

BÖTCHER (H. N.). — **Die Zerstörung von Metallen durch Hohlsgog (Kavitation)**. (3 700 Wörter & Abb.)

1936 **621 .392 & 621 .87**

Zeitschrift des Vereines deutscher Ingenieure, Nr. 51, 19. Dezember, S. 1 529.

WUNDRAM (O.). — **Einfluss des Schweissens auf die Formen im Kranbau**. (1 300 Wörter & Abb.)

Zeitschrift für das gesamte Eisenbahn-Sicherungswesen. (Berlin.)

1936 **656 .259**
Zeitschr. für das gesamte Eisenb.-Sicherungsw. Nr. 16,
10. Dezember, S. 181.

GRADL (J.). — Fahrstrassenfestlegung. (2 300 Wörter & Abb.)

1936 **625 .151 (.43)**
Zeitschr. für das gesamte Eisenb.-Sicherungsw. Nr. 16,
10. Dezember, S. 185.

HERWIG & BUDDENBERG. — Die Reichsbahnweichen. (2 700 Wörter & Abb.)

Zeitung des Vereins mitteleuropäischer Eisenbahnverwaltungen. (Berlin.)

1936 **656**
Zeitung des Ver. mitteleurop. Eisenbahnverw., Heft 49,
3. Dezember, S. 980.

BURGER. — Ist es wirtschaftlich vertretbar, die Bedienung des Stückgutverkehrs von der Schiene auf den Kraftwagen umzulegen? (3 400 Wörter.)

1936 **627 .82 (.43)**
Zeitung des Ver. mitteleurop. Eisenbahnverw., Heft 51,
17. Dezember, S. 1 013.

BRÜCKNER. — Der Rügendamm in Entwurf und Bauausführung. (7 000 Wörter & Abb.)

In English.

Annals, American Academy of Political and Social Science. (Philadelphia.)

1936 **3. (.73)**
Annals, Americ. Acad. of Political and Social Science,
November.

The American people. Studies in population. (Dealing with the composition, distribution, and growth of the population, and its relation to resources, in the United States). (33 articles.)

Bulletin, American Railway Engineering Association. (Chicago, Ill.)

1936 **656 .21 (.73) & 725 .3 (.73)**
Bulletin American Railway Engineering Association,
N° 389, September, p. 65.

Report of Committee on yards and terminals. — Hump yards. The expediting of freight car movements through yards. Scales used in railway service (proposed specifications for the manufacture and installation of two-section, knife-edge railway track scales). Bibliography on subjects relating to yards and terminals. Outline of complete field of work of committee. (20 000 words.)

1936 **613 (.73) & 621 .133.7 (.73)**
Bulletin American Railway Engineering Association,
N° 389, September, p. 93.

Report of Committee on water service, fire protection and sanitation. — Relation of railway fire protection to municipal and privately-owned waterworks. Use of phosphates in water treatment. Cause of and remedy for pitting and corrosion of locomotive boiler tubes and sheets—status of embrittlement investigations. Methods for analysis of chemicals used in water treatment. Progress in federal or state regulation relative to railway sanitation. Determination of and means for reduction of water waste. Outline of complete field of work of committee. (14 000 words.)

1936 **625 .144.4 (.73) & 625 .17 (.73)**
Bulletin American Railway Engineering Association,
N° 389, September, p. 115.

Report of Committee on maintenance of way work equipment. — Electric tie tampers. Use and adaptability of crawler-type tractors. Rail laying machines and auxiliary equipment. Track welding equipment. Power bolt tighteners. Outline of complete field of work of committee. (16 000 words & fig.)

1936 **621 .138.5 (.73), 625 .26 (.73) & 725 .33 (.73)**
Bulletin American Railway Engineering Association,
N° 389, September, p. 137.

Report of Committee on shops and locomotive terminals. — Adaptation of engine houses, shops and engine terminal layouts for handling oil-electric locomotives and railcars. Power plants. Outline of complete field of work of committee. (1 800 words.)

1936 **627 (.73) & 656 .213 (.73)**
Bulletin American Railway Engineering Association,
N° 389, September, p. 141.

Report of Committee on waterways and harbors. — Warehouse piers, coal piers, car float piers. Size and depth of slips required for various traffic conditions. What is navigable water in fact. (11 000 words & fig.)

Engineer. (London.)

1936 **621 .83**
Engineer, N° 4219, November 20, p. 536.
MERRITT (H. E.). The art of gear design. (3 000 words & fig.) (to be cont^d.)

1936 **624 .51 (.73) & 624 .7 (.73)**
Engineer, N° 4219, November 20, p. 538.
San Francisco-Oakland Bay Bridge. (6 700 words & fig.) (to be cont^d.)

1936 **669 .1 (06 (.42))**
Engineer, N° 4219, November 20, p. 541.
The Iron and Steel Institute. (4 500 words.)

1936 **621 .131.**
Engineer, N° 4219, November 20, p. 550.
FRY (L. H.). — Locomotive testing. (2 000 words.)

- 1936** **621 .338 (.42)**
 Engineer, N° 4219, November 20, p. 554.
New experimental tube trains for the L. P. T. B. (1 500 words & fig.)
-
- 1936** **625 .234 (.42)**
 Engineer, N° 4219, November 20, p. 556.
Air conditioning of railway carriages. (1 100 words & fig.)
-
- 1936** **621 .83**
 Engineer, N° 4220, November 27, p. 564.
 MERRITT (H. E.). — The art of gear design. (2 800 words & fig.) (*to be cont^d*).
-
- 1936** **624 .51 (.73) & 624 .7 (.73)**
 Engineer, N° 4220, November 27, p. 567.
San Francisco-Oakland Bay Bridge. (3 000 words & fig.) (*to be cont^d*).
-
- 1936** **621. (06 (.42) & 621 .116**
 Engineer, N° 4220, November 27, p. 580.
The modern water-tube boiler. (2 100 words.)
-
- 1936** **621 .392**
 Engineer, N° 4220, November 27, p. 581.
Automatic arc welding apparatus. (1 400 words.)
-
- 1936** **656 .212.9 (.42)**
 Engineer, N° 4220, November 27, p. 582.
The Southern Railway's new warehouse at Nine Elms. (700 words & fig.)
-
- 1936** **621. (06 (.42) & 621 .116**
 Engineer, N° 4220, November 27, p. 584.
 MUNZINGER (Fr.). — **Modern water-tube boilers** for land and marine use. (4 300 words & fig.) (*to be cont^d*).
-
- 1936** **621 .43**
 Engineer, N° 4221, December 4, p. 592.
 PITCHFORD (B. A.). — The combustion system of small high-speed compression-ignition engines. (2 500 words & fig.)
-
- 1936** **624 .51 (.73) & 624 .7 (.73)**
 Engineer, N° 4221, December 4, p. 593.
San Francisco-Oakland Bay Bridge. (2 400 words & fig.)
-
- 1936** **656 .253 (.42)**
 Engineer, N° 4221, December 4, p. 597.
Waterloo to Hampton Court signalling. (2 200 words & fig.)
-
- 1936** **656 .221**
 Engineer, N° 4221, December 4, p. 605.
The air resistance of trains. (3 000 words.)
-
- 1936** **656 .222.1 (.42)**
 Engineer, N° 4221, December 4, p. 608.
L. M. S. high-speed test run. (2 500 words & fig.)

- 1936** **621 .392 (.42) & 625 .211 (.42)**
 Engineer, N° 4221, December 4, p. 610.
Welded underframes for goods wagons. (1 000 words & fig.)
-
- 1936** **621 .116**
 Engineer, N° 4221, December 4, p. 613.
 MUNZINGER (Fr.). — **Modern water-tube boilers** for land and marine use. (4 000 words & fig.)
-
- 1936** **385. (093 (.42)**
 Engineer, N° 4222, December 11, p. 626.
 SEKON (G. A.). — **The Crystal Palace and the Railways.** (3 500 words.)
-
- 1936** **669**
 Engineer, N° 422, December 11, p. 639.
 LONGDEN (E.). — **Mechanisation of foundry operations.** (3 000 words.)

Engineering. (London.)

- 1936** **621 .33 (.42)**
 Engineering, N° 3697, November 20, p. 560.
Electric traction on the Southern Railway. (1 500 words.)
-
- 1936** **625 .234**
 Engineering, N° 3697, November 20, p. 562.
Railway-carriage air-conditioning equipment. (1 700 words & fig.)
-
- 1936** **624 .8 (.42)**
 Engineering, N° 3698, November 27, p. 573.
The Kincardine-on-Forth road bridge. (4 000 words & fig.)
-
- 1936** **621 .338 (.42)**
 Engineering, N° 3698, November 27, p. 578.
Experimental stock for the London Underground Railways. (2 800 words & fig.)
-
- 1936** **621. (06 (.42) & 621 .116**
 Engineering, N° 3698, November 27, p. 589.
The Institution of Mechanical engineers. (3 800 words.)
-
- 1936** **621. (06 (.42) & 621 .116**
 Engineering, N° 3698, November 27, p. 596.
 MUNZINGER (Friedrich). — **Modern forms of water-tube boilers.** — Paper read before the Institution of Mechanical Engineers on Friday, November 20, 1936. Abridged. (2 000 words & fig.)
-
- 1936** **621 .338 & 625 .234**
 Engineering, N° 3698, November 27, p. 600.
Steam heating on electric trains. (600 words.)
-
- 1936** **624 .8 (.73)**
 Engineering, N° 3699, December 4, p. 601.
The Triborough bridge development, New York. (2 200 words & fig.)

1936 **656 .221**
Engineering, N° 3699, December 4, p. 607.
JOHANSEN (F. C.). — The air resistance of passenger trains. — Paper read before the Institution of Mechanical Engineers on Friday, November 27, 1936. Abridged. (2 700 words & fig.)

1936 **621. (06 (.42) & 656 .221**
Engineering, N° 3699, December 4, p. 616.
The Institution of Mechanical Engineers. (5 000 words & fig.)

1936 **621 .95 (.42)**
Engineering, N° 3699, December 4, p. 619.
Railway-wheel drilling machine. (500 words.)

1936 **625 .211 (.42)**
Engineering, N° 3699, December 4, p. 621.
Welded underframes for L. M. S. R. goods wagons. (1 000 words.)

1936 **656 .212.9 (.42)**
Engineering, N° 3699, December 4, p. 627.
Warehouse for the Southern Railway at Nine Elms. (1 200 words & fig.)

1936 **656 .222.1 (.42)**
Engineering, N° 3699, December 4, p. 628.
High-speed trial runs of the London Midland and Scottish Railway. (2 500 words.)

1936 **621. (06 (.42) & 656 .221**
Engineering, N° 3700, December 11, p. 635.
JOHANSEN (F. C.). — The air resistance of passenger trains. (4 000 words.)

1936 **621 .116**
Engineering, N° 3700, December 11, p. 651.
MUNZINGER (Fr.). — Modern forms of water-tube boilers. (8 500 words.)

Engineering News-Record. (New York.)

1936 **624 .62 (.73)**
Engineering News-Record, N° 20, November 12, p. 669.
GREENE (W. K.). — Special problems of hingeless arch erection. (Steel arch of 800 ft. span for Henry Hudson bridge in New York (3 400 words & fig.)

1936 **625 .1 (06 (.73) & 625 .13 (.73)**
Engineering News-Record, N° 20, November 12, p. 688.
Railway bridge maintenance discussed by engineers. (2 100 words.)

1936 **624 .52 (.73)**
Engineering News-Record, N° 20, November 12, p. 690.
SMITH (S. M.). — Cantilever bridge erected from one end. (2 500 words & fig.)

1936 **624 .52 (.73)**
Engineering News-Record, N° 22, November 26, p. 737.
PURCELL (C. H.), ANDREW (C. E.) and WOODRUFF (G. B.). — East Bay crossing of the Bay bridge. (3 800 words & fig.)

1936 **614 .7**
Engineering News-Record, N° 22, November 26, p. 746.
LANZA (A. J.). — Control of rock dust in construction—I. Health and medical aspects of Silicosis. (3 700 words.)

1936 **624 .51 (.73)**
Engineering News-Record, N° 22, November 26, p. 757.
Mc CULLOUGH (C. B.). — Bridging the Rio Chiriqui on the Pan-American highway. (2 300 words & fig.)

1936 **614 .7**
Engineering News-Record, N° 23, December 3, p. 781.
HATCH (T. F.). — Control of rock dust in construction—II. Practical control equipment and methods. (4 400 words & fig.)

1936 **627 .82**
Engineering News-Record, N° 24, December 10, p. 807.
SUTHERLAND (R. A.). — Dam building reaches a climax. (10 000 words.)

1936 **624 .2**
Engineering News-Record, N° 24, December 10, p. 828.
ALBERT (O.). — Determining beam deflections without integrating. (2 500 words.)

Great Western Railway Magazine. (London.)

1936 **621 .138.5 (.42)**
Great Western Ry. Magazine, December, p. 578.
RICHENS (F. G.). — With the « hot-shop » men in the Swindon works. (1 400 words & fig.)

1936 **351 .757 (.42) & 385 .59 (.42)**
Great Western Ry. Magazine, December, p. 581.
The history and functions of the railway police. (Abstract of a paper by Mr. G. STEPHENS). (3 000 words.)

Journal of Applied Mechanics, A. S. M. E. (New York.)

1936 **62. (01 & 621**
Journal of applied mechanics, December, p. A-121.
BAKER (J. G.) and MIKINA (S. J.). — The calculation of dampers for systems subject to self-induced vibration. (4 500 words & fig.)

1936 **62. (01 & 621**
Journal of applied mechanics, December, p. A-131.
STEWART WAY. — Stability of rectangular plates under shear and bending forces. (3 200 words & fig.)

1936 **532 & 533**
Journal of applied mechanics, December, p. A-141.
O' BRIEN (M. P.) and FOLSOM (R. G.). — Research in fluid mechanics. (5 400 words & fig.)

Journal, Institution of Civil Engineers. (London.)

1936 **625 .13 (.54)**
Journal, Institution of Civil Engineers, N° 1, November,
p. 21.

HARVEY (B. L.). — The restauration of the breach
in the right guide bank of the Hardinge bridge. (11 000
words & fig.)

1936 **624 & 69**
Journal, Institution of Civil Engineers, N° 1, November,
p. 79.

PIPPARD (A. J.) & SPARKES (S. R.). — Simple
experimental solutions of certain structural design pro-
blems. (3 500 words & fig.)

1936 **656 .1**
Journal, Institution of Civil Engineers, N° 1, November,
p. 121.

ADAMS (W. F.). — Road traffic considered as a ran-
dom series. (3 800 words & fig.)

1936 **625 .13 (.54)**
Journal, Institution of Civil Engineers, N° 1, November,
p. 133.

HOOD (W.). — Regirdering of bridges on the Great
Indian Peninsula Railway. (800 words.)

1936 **624 .2 (.54)**
Journal, institution of civil engineers, N° 2, December,
p. 29.

NICHOLS (H. J.). — Pre-stressing bridge girders.
(700 words.)

1936 **625 .7 (.42) & 656 .1 (.42)**
Journal, Institution of Civil Engineers, N° 2, December,
p. 161.

COOK (F. Ch.). — Road design and road safety.
(5 000 words & fig.)

1936 **721 .4**
Journal, Institution of Civil Engineers, N° 2, December,
p. 281.

PIPPARD (A. J.), TRANTER (C. E.) and CHITTY
(L.). — The mechanics of the voussoir arch. (7 500
words & fig.)

Journal, Institution of Engineers, Australia.
(Sydney, N. S. W.)

1936 **697**
Journal, Institut. of Engineers, Australia, October,
N° 380.

Mc KEOWN (E. W.). — Air conditioning for com-
ert, in Australia. (11 000 words, tables & fig.)

1936 **662**
Journal, Institution of Engineers, Australia, November,
p. 415.

WILKINS (R.). — Pulverised fuel. (6 800 words
& fig.)

1936 **51. (08)**
Journal, Institution of Engineers, Australia, November,
p. 423.
MYERS (D. M.). — Some mechanical aids to calcu-
lation. (5 000 words & fig.)

Journal, Institute of Transport. (London.)

1936 **313 : 656 .1 (.42)**
Journal, Institute of Transport, December, p. 62.

KIRKUS (A. E.). — Road Transport statistics.
(10 000 words.)

1936 **347 .763 (.42) & 656 (.42)**
Journal, Institute of Transport, December, p. 73.

BILBROUGH (G. F.). — This road and rail traffic
business. (9 500 words.)

1936 **33. (.73) & 385 .1 (.73)**
Journal, Institute of Transport, December, p. 84.

CAMPBELL (C. D.). — New deal legislation and the
railways in the United States. (7 000 words.)

Mechanical Engineering. (New York.)

1936 **621 .11 (.73)**
Mechanical Engineering, December, p. 771.

BAILEY (E. G.), SMITH (A. R.) and DICKEY
(P. S.). — Steamotive. — A complete steam-generating
unit, its development and test. (4 000 words & fig.)

1936 **62. (01 & 669)**
Mechanical Engineering, December, p. 781.

SPELLER (F. N.). — Corrosion-resistant metals. —
Introductory paper to a symposium on their use in the
design of machinery and equipment. (3 000 words
& fig.)

1936 **62. (01 & 669)**
Mechanical Engineering, December, p. 784.

DIX (E. H.) and MEARS (R. B.). — Aluminium and
its alloys in the design of corrosion-resistant machinery
and equipment. (11 000 words.)

1936 **62. (01 & 669)**
Mechanical Engineering, December, p. 793.

HIERS (G. O.). — Corrosion-resistant lead equipment.
(7 000 words.)

1936 **62. (01 & 669)**
Mechanical Engineering, December, p. 799.

ANDERSON (E. A.). — Zinc in the chemical in-
dustries. (4 500 words & fig.)

1936 **62. (01 & 669)**
Mechanical Engineering, December, p. 803.

MAXWELL (H. L.). — Cast iron in chemical equip-
ment. (6 000 words & fig.)

1936 **62. (01 & 669**
Mechanical Engineering, December, p. 809.
WILKINS (R. A.). — **Copper and copper-base alloys**
in the construction of corrosion-resisting equipment and
structures. (12 000 words & fig.)

1936 **62. (01 & 669**
Mechanical Engineering, December, p. 823.
CRITCHETT (J. H.). — **Corrosion-resistant stainless**
steels and irons. (4 000 words.)

1936 **62. (01 & 669**
Mechanical Engineering, December, p. 827.
LAQUE (F. L.). — **Nickel and nickel-base alloys,**
their use in the design of corrosion-resistant machinery
and equipment. (14 000 words & fig.)

Modern Transport. (London.)

1936 **656 .222.1 (.42)**
Modern Transport, N° 923, November 21, p. 3.
L. M. S. success with **standard locomotive** and rolling
stock. To Glasgow in six hours. (2 000 words & fig.)

1936 **621 .338 (.42)**
Modern Transport, N° 923, November 21, p. 5.
Experimental London Transport tube trains. (3 000
words & fig.)

1936 **625 .234 (.91)**
Modern Transport, N° 923, November 21, p. 7.
Air conditioned coaches for Malaya. Improved rail
travel in tropical countries. (1 500 words & fig.)

1936 **621 .33 (.42)**
Modern Transport, N° 923, November 21, p. 11.
Electrification on the Southern Railway. (2 000
words.)

1936 **656 .253 (.42) & 656 .257 (.42)**
Modern Transport, N° 924, November 28, p. 3.
New Signalling at Edinburgh (Waverley West).
(2 300 words & fig.)

1936 **625 .111 (.73) & 725 .31 (.73)**
Modern Transport, N° 924, November 28, p. 5.
Express trains removed from city streets. (1 100
words & fig.)

1936 **656 .254 (.42)**
Experimental London Transport tube trains. (3 000
GREEN (W. E.). — **Telephony and railway oper-**
ation. (2 000 words.)

1936 **656 .212.9 (.42)**
Modern Transport, N° 924, November 28, p. 7.
New warehouse and granary at Nine Elms. (900 words
& fig.)

1936 **388 .42**
Modern Transport, N° 925, December 5, p. 3.
PICK (F.). — **Passenger transport in London, N° 1.**
— The past and the present. (1 800 words.)

1936 **621 .133.**
Modern Transport, N° 925, December 5, p. 4.
Locomotive feedwater treatment (1 000 words.)

1936 **621 .43 (.43)**
Modern Transport, N° 925, December 5, p. 4.
High-speed railcars in Germany. — How they are dri-
ven. (600 words.)

1936 **656 .253 (.42)**
Modern Transport, N° 925, December 5, p. 5.
London Transport instals route signalling on the
district railway. (1 700 words & fig.)

1936 **385 .585 (.42) & 659 (.42)**
Modern Transport, N° 925, December 5, p. 6.
BRUDENELL (W. C.). — **Films in railway service**
(1 800 words & fig.)

1936 **621 .43 (.42) & 625 .175 (.42)**
Modern Transport, N° 925, December 5, p. 8.
L. N. E. R. service railcar. — **For track maintenance**
(600 words & fig.)

1936 **621 .338 (.45)**
Modern Transport, N° 925, December 5, p. 9.
Streamlined electric trains in Italy. (900 words & fig.)

1936 **621 .392 (.42) & 625 .211 (.42)**
Modern Transport, N° 925, December 5, p. 11.
L. M. S. **welded underframes.** — For 12-ton covered
goods wagons. (1 000 words & fig.)

1936 **388. (.42)**
Modern Transport, N° 926, December 12, p. 4.
PICK (Fr.). — **Passenger transport in London.** —
Fifty years hence. (1 600 words.)

1936 **621 .43 (.44)**
Modern Transport, N° 296, December 12, p. 5.
Articulated railcars in France. The latest Michelin
model. (1 100 words & fig.)

1936 **625 .234 (.42)**
Modern Transport, N° 926, December 12, p. 7.
New Methods in train heating. — British-manu-
factured « Vapor » system. (1 000 words & fig.)

1936 **625 .212**
Modern Transport, N° 926, December 12, p. 8.
Maritime passenger stations. — Modern require-
ments. (950 words.)

1936 **656**
Modern Transport, N° 927, December 19, p. 3.
GAUNT (W. H.). — **Transport and the user.** —
Freedom of choice for the trader. (1 600 words.)

1936 **621 .33 (.438)**
Modern Transport, N° 927, December 19, p. 5.
Electrification of Polish State Railways. (1 100 words
& fig.)

- 1936** **621 .135.2 (.436)**
Modern Transport, N° 927, December 19, p. 6.
Axlebox bearings for locomotives. (400 words & fig.)
- 1936** **388 (.42) & 625 .4 (.42)**
Modern Transport, N° 927, December 19, p. 8.
London Transport Railway development plans. — Extensions and improvements of Underground routes. (3 000 words & fig.)
- Proceedings, American Society of Civil Engineers.**
(New York.)
- 1936** **532 & 621 .31**
Proceedings, American Society of Civil Engineers, N° 9, November, p. 1343.
VOETSCH (Ch.) & FRESSEN (M. H.). — Economic diameter of steel penstocks. (6 000 words & fig.)
- 1936** **625 .13**
Proceedings, American Society of Civil Engineers, N° 10, December, p. 1519.
EREMIN (A. A.). — Analysis of stresses in subaqueous tunnel tubes. (4 500 words & fig.)
- 1936** **51 & 624 .2**
Proceedings, American Society of Civil Engineers, N° 10, December, p. 1529.
HALL (D. B.). — Deflections by geometry. (5 000 words & fig.)
- 1936** **613**
Proceedings, American Society of Civil Engineers, N° 10, December, p. 1543.
Filter sand for water purification plants. (25 000 words & fig.)
- Proceedings, Institution of Mechanical Engineers.**
(London.)
- 1936** **621 .1**
Proceedings, Institution of Mechanical Engineers, Vol. 132, January-March, p. 3.
JOHNSON (Jn.). — The future of steam propulsion. (12 500 words & fig.)
- 1936** **621 .13 (093)**
Proceedings, Institution of Mechanical Engineers, Vol. 132, January-March, p. 39.
HUDSON (Sir Thomas). — James Watt. (7 300 words.)
- 1936** **532 & 533**
Proceedings, Institution of Mechanical Engineers, Vol. 132, January-March, p. 201.
GOUGH (H. J.). — First report of the pipe flanges Research Committee. (45 000 words & fig.)
- 1936** **621 .43**
Proceedings, Institution of Mechanical Engineers, Vol. 132, January-March, p. 397.
DAVIES, ALCOCK, LAWSON, EVANS, ATTWOOD, JOPKINS and ROWE. — Internal combustion engine group. Symposium of papers on fuel injection equipment. (12 000 words & fig.)

- 1936** **621 .43**
Proceedings, Institution of Mechanical Engineers, Vol. 132, January-March, p. 431.
MUCKLOW, TOOKEY, LONGSON, LE MESURIER, WILLANS and MORLAND. — International combustion engine group. Symposium of papers on methods of testing internal combustion engines and comparative fuel economy of engines on test and in service. (14 000 words & fig.)
- 1936** **533**
Proceedings, Institution of Mechanical Engineers, Vol. 132, January-March, p. 467.
KEARTON (W. J.). — Recent developments in turbo-blowers and compressors. (22 000 words & fig.)
- 1936** **62. (01 & 669)**
Proceedings, Institution of Mechanical Engineers, Vol. 132, January-March, p. 549.
GOUGH (H. J.) and POLLARD (H. V.). — The effect of specimen form on the resistance of metals to combined alternating stresses. (7 000 words & fig.)
- Proceedings, Institution of Railway Signal Engineers. (Reading).**
- 1936** **656 .25 (0)**
Proceedings, Institution of Railway Signal Engineers, Part I, February, 1936 to September, 1936, p. 19.
ROBERTS (W. S.). — Presidential address delivered at the annual general meeting of the institution, on February 12 th, 1936. (5 300 words.)
- 1936** **656 .257**
Proceedings, Institution of Railway Signal Engineers, Part I, February, 1936 to September, 1936, p. 34.
LANGLEY (P. A.). — Remote control and operation of outlying points. Paper read before the Institution of Electrical Engineers on March 11th, 1936, and discussion thereof. (15 000 words.)
- 1936** **656 .256.2 & 656 .257**
Proceedings, Institution of Railway Signal Engineers, Part I, February, 1936 to September, 1936, p. 75.
WEBB (W. H.). — Some notes on electric interlocking. (10 000 words.)
- 1936** **656 .257**
Proceedings, Institution of Railway Signal Engineers, Part I, February, 1936 to September, 1936, p. 103.
PROUD (R. S.). — Electro-pneumatic operation for signalling apparatus. (10 000 words.)
- 1936** **01 : 656 .25 (06 (.42)**
Proceedings, Institution of Railway Signal Engineers, Part I, February, 1936 to September, 1936, p. 189.
Library catalogue.

Railway Age. (New York.)

1936 **625 .232 (.71)**
 Railway Age, N° 20, November 14, p. 709.
 C. P. R. inaugurates high-speed local passenger service. (2 600 words & fig.)

1936 **656**
 Railway Age, N° 20, November 14, p. 719.
 MOULTON (H. G.). — Our transport plant is overbuilt. (3 800 words.)

1936 **656 .259 (.73)**
 Railway Age, N° 20, November 14, p. 725.
 Dragging equipment detectors. (3 000 words & fig.)

1936 **621 .131.3**
 Railway Age, N° 20, November 14, p. 729.
 FRY (L. H.). — Suggestions for locomotive testing. (1 900 words.)

1936 **621 .43 (.73)**
 Railway Age, N° 21, November 21, p. 746.
 Baldwin Diesel-electric switcher. (2 500 words & fig.)

1936 **33. (06 (.73) & 385**
 Railway Age, N° 21, November 21, p. 749.
 Learned group discusses railroads. (6 200 words.)

1936 **621 .139 (.73) & 625 .27 (.73)**
 Railway Age, N° 21, November 21, p. 753.
 SORENSEN (A. L.). — Essentials of the service of supply. (3 300 words and fig.)

1936 **385 .3 (.73)**
 Railway Age, N° 21, November 21, p. 759.
 Commissioners hold annual meeting. (4 600 words.)

1936 **625 .23 (.73)**
 Railway Age, N° 21, November 21, p. 763.
 Passenger Officers meet at New Orleans. (2 800 words.)

1936 **385 .3 (.73)**
 Railway Age, N° 21, November 21, p. 767.
 New Book. (500 words.)

1936 **62. (01 & 625 .246**
 Railway Age, N° 22, November 28, p. 780.
 SCHRAMM (G. N.), TAYLERSON (E. S.) and LARABEE (C. P.). — Corrosion of steel cars by coal. (5 800 words & fig.)

1936 **656 .25 (06 (.73)**
 Railway Age, N° 22, November 28, p. 789.
 Modern signaling and track maintenance feature club discussion. (Past developments and increased demands arising from present-day high-speed operation). (4 500 words & fig.)

1936 **624 .32 (.73)**
 Railway Age, N° 23, December 5, p. 821.
 Wabash completes New Missouri river crossing at St. Charles. (2 600 words & fig.)

1936 **625 .232 (.73)**
 Railway Age, N° 23, December 5, p. 825.
 Frisco builds new passenger cars. (1 200 words & fig.)

1936 **656 .1 (.73)**
 Railway Age, N° 23, December 5, p. 829.
 Labor conditions in trucking. — Report by formal Co-ordinator Eastman shows long hours and low pay in intercity operations. (5 000 words.)

1936 **385 .52 (.73)**
 Railway Age, N° 23, December 5, p. 833.
 What are lowest U. S. A. railway wages? (3 400 words.)

1936 **656 .254 (.73)**
 Railway Age, N° 23, December 5, p. 836.
 Train communication system. (600 words & fig.)

1936 **625 .111 (.73) & 625 .162 (.73)**
 Railway Age, N° 24, December 12, p. 857.
 Grade crossings are disappearing rapidly on Staten Island. (4 300 words & fig.)

1936 **385 .114 (.73) & 656 .2 (.73)**
 Railway Age, N° 24, December 12, p. 863.
 DOWNS (L. A.). — Means used to boost efficiency. (3 400 words.)

1936 **621 .133**
 Railway Age, N° 24, December 12, p. 866.
 Symposium on feedwater heating. — Five manufacturers representatives describe economies effected with different types of locomotive heaters. (5 700 words.)

Railway Engineering and Maintenance. (Chicago)

1936 **625 .1**
 Railway Engineering and Maintenance, December 1936, p. 776.
 Meeting winter's challenge (6 700 words & fig.)

1936 **691 & 692**
 Railway Engineering and Maintenance, December 1936, p. 782.
 DUNCAN (H. R.). — Termites in railway structures. (3 100 words & fig.)

1936 **625 .1**
 Railway Engineering and Maintenance, December 1936, p. 786.
 High-speed track. — How good must it be? (3 700 words & fig.)

1936 **625 .13 (.73) & 625 .17 (.73)**
 Railway Engineering and Maintenance, December 1936, p. 791.
 Union Pacific adopts new methods in bridge maintenance and renewals. (2 600 words & fig.)

Railway Gazette. (London.)

- 1936** **625 .111 (.42)**
Railway Gazette, N° 20, November 13, p. 786.
BARTER (S.). — **Flying and burrowing junctions** on the Southern Railway—II. (1 900 words & fig.)
-
- 1936** **385. (091 (.41) & 625 .1 (.41)**
Railway Gazette, N° 20, November 13, p. 789.
The Irish International main line—II. (3 700 words & fig.)
-
- 1936** **656 .253 (.42)**
Railway Gazette, N° 20, November 13, p. 795.
Power signalling at Waterloo. (1 000 words & fig.)
-
- 1936** **656 .222.1 (.42)**
Railway Gazette, N° 20, November 13, p. 805.
Locomotive working on the Silver Jubilee. (900 words.)
-
- 1936** **385 .586 (.42)**
Railway Gazette, N° 20, November 13, p. 809.
L. M. S. R. Derby staff college scheme. (1 600 words.)
-
- 1936** **621 .43 & 621 .8**
Railway Gazette, N° 21, November 20, p. 845.
An Automatic and infinitely variable gear. (The Hobbs Gear adaptable to road and rail vehicles). (2 200 words & fig.)
-
- 1936** **656 .1 (.42)**
Railway Gazette, N° 21, November 20, p. 851.
The New Blackpool omnibus station (owned by a group of railway-associated companies). (1 200 words & fig.)
-
- 1936** **625 .234 (.91)**
Railway Gazette, N° 21, November 20, p. 855.
New Air conditioned coaches for Malaya. (1 600 words & fig.)
-
- 1936** **621 .338 (.42)**
Railway Gazette, N° 21, November 20, p. 859.
Faster trains for London Underground. (750 words & fig.)
-
- 1936** **656 .222.1 (.42)**
Railway Gazette, N° 21, November 20, p. 866.
L. M. S. R. six-hour schedule trial runs, London-Glasgow-London. (1 600 words & fig.)
-
- 1936** **656 .253 (.42) & 656 .257 (.42)**
Railway Gazette, N° 22, November 27, p. 891.
Power Signalling at Edinburgh, L. N. E. R. (1 700 words & fig.)
-
- 1936** **656 .212.9 (.42)**
Railway Gazette, N° 22, November 27, p. 895.
New Southern Railway warehouse at Nine Elms. (800 words & fig.)

- 1936** **656 .222.1 (.42)**
Railway Gazette, N° 22, November 27, p. 900.
Six-hour London-Glasgow-London trial runs, L. M. S. R. (2 800 words & fig.)
-
- 1936** **621 .392 & 665 .882**
Railway Gazette, N° 23, December 4, p. 939.
BONDY (O.). — **Welding practice** for railway engineers. (2 500 words.)
-
- 1936** **625 .235**
Railway Gazette, N° 23, December 4, p. 941.
BASSETT (H. N.). — **Modern methods of finishing railway vehicles.** — 1 : a review of present day paint shop practice. (1 700 words.)
-
- 1936** **621 .132.3 (.54)**
Railway Gazette, N° 23, December 4, p. 942.
New locomotives for overseas railways. (900 words & fig.)
-
- 1936** **625 .174**
Railway Gazette, N° 23, December 4, p. 945.
Reducing the effects of ice and snow. (700 words & fig.)
-
- 1936** **621 .392 (.42) & 625 .211 (.42)**
Railway Gazette, N° 23, December 4, p. 947.
Welded underframes for L. M. S. R. goods wagons (1 000 words & fig.)
-
- 1936** **656 .221**
Railway Gazette, N° 23, December 4, p. 952.
The air resistance of passenger trains. (2 900 words.)
-
- 1936** **625 .234 (.51)**
Railway Gazette, N° 24, December 11, p. 975.
Railway carriage heating. (800 words & fig.)
-
- 1936** **625 .235**
Railway Gazette, N° 24, December 11, p. 977.
BASSETT (H. N.). — **Modern methods of finishing railway vehicles.** (2 300 words.)
-
- 1936** **625 .232 (.41)**
Railway Gazette, N° 24, December 11, p. 978.
New suburban carriages, Great Southern Railways, Ireland. (400 words & fig.)
-
- 1936** **621 .132.1 (.42)**
Railway Gazette, N° 24, December 11, p. 980.
Locomotives for the home railways. (250 words & fig.)
-
- 1936** **621 .9 (.42)**
Railway Gazette, N° 24, December 11, p. 982.
A new machine tool for railway shops. (400 words & fig.)
-
- 1936** **656 .1 (.42) & 656 .261 (.42)**
Railway Gazette, N° 25, December 18, p. 1023.
Organisation of a railway company's road motor engineer's department—I. (1 200 words & fig.)

1936 **656 .1 (.43)**
 Railway Gazette, N° 25, December 18, p. 1026.
 Reichsbahn road services replace **light railways**. (500 words & fig.)

1936 **656 .261 (.42)**
 Railway Gazette, N° 25, December 18, p. 1029.
Pickfords heavy haulage department. (1 000 words & fig.)

1936 **621 .132.3 (.942)**
 Railway Gazette, N° 25, December 18, p. 1035.
New streamlined locomotives, South Australian Railways. (400 words & fig.)

1936 **625 .111 (.73) & 625 .162 (.73)**
 Railway Gazette, N° 26, December 25, p. 1060.
Elimination of level crossings in North America. (1 400 words & fig.)

1936 **625 .6 (.493)**
 Railway Gazette, N° 26, December 25, p. 1062.
 The **Belgian light railway system**. (600 words & fig.)

1936 **656 .24 (.42)**
 Railway Gazette, N° 26, December 25, p. 1066.
 An interesting **freight traffic problem**. (700 words & fig.)

1936 **656. (.68)**
 Railway Gazette, N° 26, December 25, p. 1067.
 A **railway-owned Dominion air service**. (1 400 words & fig.)

1936 **621 .43 (.45)**
 Diesel Ry. Traction, p. 912, Supplt. to the Ry. Gazette, November 27.
Triple-car super-speed trains in Italy. (700 words & fig.)

1936 **621 .43 (.44)**
 Diesel Ry. Traction, p. 913, Supplt. to the Ry. Gazette, November 27.
 A **light railcar with unusual features**. (600 words & fig.)

1936 **621 .43 (.82)**
 Diesel Ry. Traction, p. 914, Supplt. to the Ry. Gazette, November 27.
British Oil engines for Central Argentine Railway. (1 100 words & fig.)

1936 **621 .43 (.492)**
 Diesel Ry. Traction, p. 915, Supplt. to the Ry. Gazette, November 27.
More Diesels for Holland. (300 words & fig.)

1936 **621 .43 (.42)**
 Diesel Ry. Traction, p. 916, Supplt. to the Ry. Gazette, November 27.
Broad-gauge locomotive for Northern Ireland. (800 words & fig.)

1936 **385 .114 (.73) & 621 .43 (.43)**
 Diesel Ry. Traction, p. 917, Supplt. to the Ry. Gazette, November 27.

Shunting locomotive operating costs. (400 words & fig.)

1936 **621 .43 (.43)**
 Diesel Ry. Traction, p. 919, Supplt. to the Ry. Gazette, November 27.

HORNBUCKLE (T.). — The application of **Diesel engines** to rail traction. (2 300 words & fig.)

1936 **621 .43 (.43)**
 Diesel Ry. Traction, p. 922, Supplt. to the Ry. Gazette, November 27.

Japanese local freight Diesel locomotives. (600 words & fig.)

1936 **621 .43 (.43)**
 Diesel Ry. Traction, p. 924, Supplt. to the Ry. Gazette, November 27.

What makes a good **lubricating oil**? (1 000 words & fig.)

1936 **621 .33 (.33)**
 Electric Ry. Traction, p. 1003, Supplt. to the Ry. Gazette, December 11.

Electrification in South Africa. (1 100 words.)

1936 **621 .33 (.33)**
 Electric Ry. Traction, p. 1004, Supplt. to the Ry. Gazette, December 11.

Faster trains for London Underground. (2 500 words & fig.)

Railway Magazine. (London.)

1936 **656 .222.1 (.222.1)**
 Railway Magazine, December, p. 394.
European express trains in the Summer of 1936. (2 000 words & tables.)

1936 **656 .222.1 (.222.1)**
 Railway Magazine, December, p. 399.
ALLEN (C. J.). — **British locomotive practice & performance**. (2 000 words & fig.)

1936 **385. (091 .091)**
 Railway Magazine, December, p. 413.
Dover, the railhead of Britain. (4 500 words & fig.)

1936 **385. (091 .091)**
 Railway Magazine, December, p. 429.
KATIN (L.) & FRAZER (I. R.). — **Railways of the Near East**. (3 900 words et fig.)

Railway Mechanical Engineer. (Philadelphia.)

1936 **625 .232 (.232)**
 Railway Mechanical Engineer, November, p. 467.
Weight saved in new Hiawatha cars. (3 000 words & fig.)

1936 **621 .132.3 (.71)**
 Railway Mechanical Engineer, November, p. 473.
High-speed steam locomotive for C. P. R. (2 300 words & fig.)

1936 **621 .134.2**
 Railway Mechanical Engineer, November, p. 479.
SMITH (J. E.). — Link motion valve gear. — Part III. (800 words & 3 tables.)

1936 **62. (01 & 621 .13**
 Railway Mechanical Engineer, November, p. 481.
WILLIAMS (F. H.). — Failures of locomotive parts. (2 600 words & fig.)

1936 **621 .132.8 (.73)**
 Railway Mechanical Engineer, November, p. 485.
New Haven steam rail train. (3 300 words & fig.)

1936 **621 .135.3 & 625 .13**
 Railway Mechanical Engineer, November, p. 491.
CLYNE (R. W.). — Causes of failures of railroad springs. (3 000 words & fig.)

1936 **625 .214 (.73)**
 Railway Mechanical Engineer, November, p. 493.
Disc-Flo Journal bearing unit for high-speed service. (1 200 words & fig.)

1936 **621 .43 (.73)**
 Railway Mechanical Engineer, December, p. 523.
New Haven Diesel switchers. (4 300 words & fig.)

1936 **625 .232 (.71)**
 Railway Mechanical Engineer, December, p. 529.
Light-weight coaches. (3 000 words & fig.)

1936 **62. (01 & 621 .13**
 Railway Mechanical Engineer, December, p. 534.
WILLIAMS (F. H.). — Locomotive parts. (2 800 words & fig.)

1936 **621 .133.8**
 Railway Mechanical Engineer, December, p. 538.
Improved boiler check valve. (250 words & fig.)

Railway Signaling. (Chicago.)

1936 **656 .25 (0**
 Railway Signaling, December, p. 623.
ANDERSON (B. T.). — Demands for modern signaling. (6 000 words & fig.)

1936 **625 .162 (.73) & 656 .259 (.73)**
 Railway Signaling, December, p. 629.
Instructions for crossing protection in New-York. (500 words.)

1936 **625 .162 (.73) & 656 .259 (.73)**
 Railway Signaling, December, p. 630.
\$ 541 000 highway crossing signal program in Indiana. (5 000 words & fig.)

1936 **656 .259 (.73)**
 Railway Signaling, December, p. 635.
Dragging equipment detectors. (400 words.)

1936 **656 .256.3 (.71)**
 Railway Signaling, December, p. 636.
Automatics on Canadian Pacific. (2 700 words & fig.)

1936 **656 .25 (0 (.73)**
 Railway Signaling, December, p. 639.
DAVIS MOORE (A.). — Repairing electro-pneumatic apparatus. (3 000 words & fig.)

1936 **656 .254 (.73)**
 Railway Signaling, December, p. 644.
Train communication system. (1 100 words & fig.)

1936 **656 .257 (.492)**
 Railway Signaling, December, p. 646.
New type interlocking machine in Holland. (600 words & fig.)

South African Railways and Harbours Magazine. (Johannesburg.)

1936 **385. (064 (.68)**
 South African Railways and Harbours Magazine, December, p. 1551.
The South African Railways at the Empire Exhibition. (9 000 words & fig.)

The Locomotive. (London.)

1936 **621 .132.3 (.73)**
 The Locomotive, N° 531, November 14, p. 339.
The Mercury Express, New York Central lines. (500 words & fig.)

1936 **621 .132.7 (.73)**
 The Locomotive, N° 531, November 14, p. 340.
0-10-2 or « Union » type locomotive, Union Railroad, U. S. A. (800 words & fig.)

1936 **621. (06 (.42 & 621 .13 (0**
 The Locomotive, N° 531, November 14, p. 346.
The Institution of Mechanical Engineers. (4 500 words.)

1936 **621 .43 (.931)**
 The Locomotive, N° 531, November 14, p. 350.
Petrol driven railcar, New Zealand Govt Rys. (600 words & fig.)

1936 **621 .132.3 (091 (.493)**
 The Locomotive, N° 531, November 14, p. 352.
A curious old Belgian locomotive. (1 900 words & fig.)

1936 **621 .43 (.438)**
 The Locomotive, N° 531, November 14, p. 367.
A converted polish railcar. (300 words.)

1936 **656 .221 (.42)**
The Locomotive, N° 532, December 15, p. 371.
Air resistance of passenger trains. (1 100 words.)

1936 **621 .132.8 (.485)**
The Locomotive, N° 532, December 15, p. 373.
New turbine locos, Grangesberg-Oxelösund Ry., Sweden. (300 words & fig.)

1936 **621 .132.3 (.52)**
The Locomotive, N° 532, December 15, p. 374.
« **Mikado** » express passenger loco., Bulgarian state Rys. (700 words & fig.)

1936 **656 .222.1 (.42)**
The Locomotive, N° 532, December 15, p. 375.
London, Midland & Scottish Railway. — **Experimental high-speed test runs** between London and Glasgow. (3 000 words & fig.)

1936 **621 .132.5 (.71)**
The Locomotive, N° 532, December 15, p. 379.
2-8-2 type freight locomotives Canadian National Rys. (500 words & fig.)

1936 **621 .338 (.42)**
The Locomotive, N° 532, December 15, p. 381.
New tube trains, London Transport Board. (2 800 words & fig.)

1936 **625 .234 (.91)**
The Locomotive, N° 532, December 15, p. 386.
Air conditioning for Federated Malay States Rys. carriages. (1 600 words & fig.)

1936 **621 .13 (.06) (.42)**
The Locomotive, N° 532, December 15, p. 389.
HANCOCK (J. S.). — **The Institution of Locomotive Engineers.** — Locomotive feed-water treatment. Abstract of paper read at the Institution of Mechanical Engineers on November 25th, 1936. (3 500 words.)

Transactions, American Society of Mechanical Engineers. (New York.)

1936 **621 .392**
Transactions, Amer. Soc. of Mech. Engineers, October, p. 497.
JENNINGS (Ch. H.). — **Welding design.** (9 000 words & fig.)

1936 **621 .392 & 669 .1**
Transactions, Amer. Soc. of Mech. Engineers, October, p. 511.
KINZEL (A. B.). — **Welding alloy steels.** (2 800 words.)

1936 **621 .392 & 669 .1**
Transactions, Amer. Soc. of Mech. Engineers, October, p. 515.
WARNER (W. L.). — **Arc welding of structural alloy steels.** (3 500 words & fig.)

1936 **621**
Transactions, Amer. Soc. of Mech. Engineers, October, p. 527.
MARSH (H. G.). — **Rolled (welded) steel in machine construction.** (1 700 words.)

1936 **621**
Transactions, Amer. Soc. of Mech. Engineers, October, p. 529.
WILLS (C. A.) and LINDEMUTH (F. L.). — **Welding heavy machinery.** (3 200 words & fig.)

1936 **621 .392 & 669**
Transactions, Amer. Soc. of Mech. Engineers, October, p. 535.
HOOK (I. T.). — **Applications of copper-alloy welding.** (4 700 words & fig.)

1936 **621 .392 & 669**
Transactions, Amer. Soc. of Mech. Engineers, October, p. 541.
FLOCKE (F. G.) and SCHOENER (J. G.). — **The electric welding of monel and nickel.** (4 500 words & fig.)

1936 **621 .392 & 669**
Transactions, Amer. Soc. of Mech. Engineers, October, p. 547.
HÖGLUND (G. O.). — **The welding of aluminum alloys.** (3 800 words & fig.)

1936 **621 .392 & 669**
Transactions, Amer. Soc. of Mech. Engineers, October, p. 553.
BROWN (J. L.). — **Casting or welding in machine design.** (4 500 words & fig.)

1936 **621 .43 & 669**
Transactions, Amer. Soc. of Mech. Engineers, October, p. 589.
BECKER (A. E.) and REED (M. J.). — **History and present status of research and specifications of Diesel fuel oil.** (4 300 words.)

1936
Transactions, Amer. Soc. of Mech. Engineers, November, p. 599.
RETTALIATA (J. T.). — **Undercooling in steam nozzles.** (4 200 words & fig.)

1936 **62. (01 & 621)**
Transactions, Amer. Soc. of Mech. Engineers, November, p. 607.
ROBERTS (J. L.) and GREENTREE (C. D.). — **Turbine supervisory instruments and records.** (4 800 words & fig.)

1936 **621**
Transactions, Amer. Soc. of Mech. Engineers, November, p. 615.
SCHWENDNER (A. F.) and LUOMA (A. A.). — **Proposed-turbine regulation problem.** (5 000 words & fig.)

1936 **621 .165 (.73)**
Transactions, Amer. Soc. of Mech. Engineers, November p. 621.
STEEN-JOHNSEN (H.). — Supervising instruments for the 165 000-Kw. turbine at the Richmond Station. (3 800 words & fig.)

1936 **621 .115**
Transactions, Amer. Soc. of Mech. Engineers, November p. 627.
VAN HENGEL (G. H.). — Tests of a 50 000-Sq Ft condenser at widely varying temperatures, velocities of inlet water, and loads. (12 000 words & fig.)

1936 **669 .1**
Transactions, Amer. Soc. of Mech. Engineers, November p. 643.
WHITE (A. E.), CLARK (C. L.) and CROCKER (S.). — Physical-property uniformity in valve-body steel castings. (3 000 words & fig.)

1936 **621 .6**
Transactions, Amer. Soc. of Mech. Engineers, November p. 649.
BINDER (R. C.) and KNAPP (R. T.). — Experimental determinations of the flow characteristics in the volutes of centrifugal pumps. (7 000 words & fig.)

1936 **621 .94**
Transactions, Amer. Soc. of Mech. Engineers, November p. 685.
BOSTON (O. W.) and GILBERT (W. W.). — A study of cutting fluids applied to the turning of monel metal. (3 300 words & fig.)

1936 **662**
Transactions, Amer. Soc. of Mech. Engineers, November p. 701.
FRASER (Th.). — Coal preparation by the air-sand process. (2 200 words & fig.)

1936 **662**
Transactions, Amer. Soc. of Mech. Engineers, November p. 705.
GRIFFEN (Jn.). — The Rheolaveur coal-cleaning process. (3 200 words & fig.)

1936 **536**
Transactions, Amer. Soc. of Mech. Engineers, November p. 719.
SMITH (J. F. Downie). — The thermal conductivity of liquids. (4 300 words & fig.)

1936 **625 .215 (.73) & 669 .1 (.73)**
Transactions, Amer. Soc. of Mech. Engineers, November p. 727.
BARROWS (D. S.). — The use of alloy steels for side frames and bolsters of freight-car trucks. (2 000 words & fig.)

1936 **62. (01 & 621**
Transactions, Amer. Soc. of Mech. Engineers, November p. 733.
SODERBERG (C. R.). — The interpretation of creep tests for machine design. (5 500 words & fig.)

1936 **62. (01 & 669 .1**
Transactions, Amer. Soc. of Mech. Engineers, November p. 745.
WEAVER (S. H.). — The creep curve and stability of steels at constant stress and temperature. (5 000 words & fig.)

Transit Journal. (NewYork.)

1936 **621 .33 (.73) & 625 .62 (.73)**
Transit Journal, November, p. 438.
SNOW (B.). — Trolley bus service begins at Portland. (2 000 words & fig.)

1936 **625 .62 (.73)**
Transit Journal, December, p. 471.
400 Ft. of track per day. (1100 words & fig.)

1936 **388 & 621 .33**
Transit Journal, December, p. 474.
WILLIAMS (A. R.). — Why trolley buses ? (1 700 words & fig.)

1936 **388. (.73) & 621 .338 (.73)**
Transit Journal, December, p. 478.
JORDAN (H. E.). — Rebuilding 215 cars (converting vehicles for one-man-two-man operation in Los Angeles. (700 words & fig.)

1936 **625 .235 (.73) & 698. (.73)**
Transit Journal, December, p. 479.
Philadelphia Rapid Transit painting practice. (600 words & fig.)

In Spanish.

Revista de Obras Públicas. (Madrid.)

1936 **624 : 63 (.460)**
Revista de Obras Públicas, noviembre, p. 376.
DEL PINO (F.). — Nuevo puente sobre el rio Guadarrama, en el kilómetro 66 de la línea de Madrid a Valencia de Alcáñtera. (1 300 palabras & fig.)

In Italian.

Annali dei lavori pubblici. (Roma.)

1936 **624 .2**
Annali dei lavori pubblici, novembre, p. 874.
TAGLIACOZZO (C.). — Sulla stabilita dell' equilibrio elastico nel portale. (2 900 parole.)

La tecnica professionale. (Firenze.)

1936 **621 .335 (.45)**
La tecnica professionale, dicembre, p. 270.
ELENA. — Il circuito elettrico dei motori di trazione nelle automotrici gr. E. 624 (001-002) F. S. (1 200 parole & fig.)

Rivista tecnica delle ferrovie italiane. (Roma.)

1936 **625 .5 (.494)**
 Rivista tecnica delle ferrovie ital., 15 novembre, p. 260.
 FUORTES (G. C.) & CAMOSSO (E.). — La funivia
 del Cervino. (9 000 parole & fig.)

1936 **656 .221**
 Rivista tecnica delle ferrovie ital., 15 novembre, p. 280.
 SALVINI (F.). — Relazioni analitiche e grafiche fra
 resistenza al moto d'un treno, potenza e velocità. (1 000
 parole & fig.)

1936 **656 .256**
 Rivista tecnica delle ferrovie ital., 15 novembre, p. 295.
 CALOSI (C.). — Dei circuiti di binario. (5 400 pa-
 role & fig.)

In Dutch.

De Ingenieur. (Den Haag.)

1936 **621 .8**
 De Ingenieur, N° 49, 4 December, p. W. 149.
 VELDMAN (E. W.). — Hydraulische koppelingen.
 (3 600 woorden & fig.)

1936 **691**
 De Ingenieur, N° 49, 4 December, p. Bt. 691.
 EMPERGER (F.). — Normalisatie van den factor
 « n » bij gewapend beton. (2 100 woorden & fig.)

1936 **624 .32 (.492)**
 De Ingenieur, N° 50, 11 December, p. A. 405.
 COOL (W.). — De moerdijkbrug. (2 100 woorden
 & fig.)

1936 **385 .113 (.4)**
 De Ingenieur, N° 52, 25 December, p. A. 429.
 VERSCHOOR (E.). — Bedrijfsresultaten van spoor-
 wegen in Westelijk Europa in 1935. (800 woorden.)

Spoor- en Tramwegen. (Utrecht.)

1936 **625 .144.2**
 r en Tramwegen, N° 25, 8 December, p. 591.
 SSER (G. F.). — Verbeteren van bogen door de
 auijvingsmethode. (2 300 woorden & fig.)

In Polish.
 (= 91.885)

Inzynier Kolejowy. (Warszawa.)

1936 **621 .392 (.438) = 91 .8**
 & **624 .32 (.438) = 91 .8**
 Inzynier Kolejowy, N° 11, p. 388.
 ZURAKOWSKI (S.). — Pavilion of scientific
 search at the metallurgical and electrical exhibition
 Warsaw. (1 800 words & fig.)

1936 **621 .131.1 = 91 .8**
 Inzynier Kolejowy, N° 11, p. 391.
 MADEYSKI (J.). — Efficiency of the Os 24 type loc
 motive. (4 800 words & fig.)

1936 **625 .143.3 = 91 .8**
 Inzynier Kolejowy, N° 11, p. 399.
 LUBINSKI (B.). — Rail wear. (3 600 words.)

1936 **385 (.438) = 91 .8**
 Inzynier Kolejowy, N° 12, p. 423.
 MUSZYNSKI (T.). — The communications proble
 in Poland. (3 600 words.)

1936 **725 .43 = 91 .8**
 Inzynier Kolejowy, N° 12, p. 426.
 KRACZKIEWICZ (A.). — The workshop of the f
 ture. (4 500 words & fig.)

1936 **621 .13 (.43) = 91 .8**
 Inzynier Kolejowy, N° 12, p. 433.
 PAWLOWSKI (A.). — The present-day policy
 regards locomotive building in Germany. (3 400 wor
 & fig.)

In Portuguese.

Gazeta dos caminhos de ferro. (Lisboa.)

1936 **624 .32 (.46)**
 Gazeta dos caminhos de ferro, N° 1175. 1 de dezembro
 p. 568.
 GONÇALVES (A. F.). — Renovação dos tramos m
 talicos das pontes da linha de Sintra, entre Alcant
 e Campolide. (9 quadros & fig.)

MONTHLY BIBLIOGRAPHY OF RAILWAYS ⁽¹⁾.

PUBLISHED UNDER THE SUPERVISION OF

P. GHILAIN,

General Secretary of the Permanent Commission of the International Railway Congress Association.

(MARCH 1937)

[016.385. (02)]

I. — BOOKS.

In French.

1937 **62. (02)**
Agenda Béranger 1937.
 Paris et Liège. Librairie Polytechnique Ch. Béranger.
 1 carnet de poche, 384 pages. (Prix : 16 fr. français.)

1937 **72. (02)**
AUCAMUS (E.).
Bâtiment.
 Paris, Dunod, 92, rue Bonaparte. 1 agenda, 338 pages,
 69 figures. (Prix : 20 fr. français.)

1937 **669. (02)**
CAZAUD (R.).
Métallurgie.
 Paris, Dunod, 92, rue Bonaparte. 1 agenda, 328 pages
 et 61 figures. (Prix : 20 fr. français.)

1937 **62. (02)**
CLAUDEL (J.).
 Aide-mémoire des ingénieurs, architectes, entrepre-
 neurs, conducteurs de travaux, agents voyers, dessina-
 teurs, etc.
 Paris, Dunod, 92, rue Bonaparte. 2 volumes, 2 296 pa-
 ges, 1 604 figures. (Prix : 95 fr. français.)

1937 **691. (02)**
FORESTIER (V.).
Béton armé.
 Paris, Dunod, 92, rue Bonaparte. 1 agenda, 336 pages
 et 236 figures. (Prix : 20 fr. français.)

1937 **537. (02)**
FOUCAULT (L. D.).
Electricité.
 Paris, Dunod, 92, rue Bonaparte. 1 agenda, 392 pages,
 119 figures. (Prix : 20 fr. français.)

1937 **621. (02)**
IZART (J.).
Construction mécanique.
 Paris, Dunod, 92, rue Bonaparte. 1 agenda, 340 pages
 et 199 figures. (Prix : 20 fr. français.)

1937 **385. (02)**
PLACE (P.).
Chemins de fer.
 Paris, Dunod, 92, rue Bonaparte. 1 agenda 407 pages
 et 98 figures. (Prix : 20 fr. français.)

In German.

1936 **691**
BAUER (O.), KRÖHNKE (O.) und MASING (G.).
Die Korrosion des Eisens und seiner Legierungen.
 Leipzig, Hirzel, S. 1 Band. (Preis : 37.50 R.M.)

1936 **621 .43**
FIEBELKORN (H.).
**Fahrzeug-Diesel-Motoren und Fahrzeug-Gaz-Generato-
 ren in Wirkungsweise, Bau, Betrieb und Anwendung.**
 Stuttgart, Ernst Heinrich Moritz. 1 Band, 264 Seiten,
 263 Bilder und 15 Zahlentafeln. (Preis : 16 R.M.)

1936 **682**
KEEL (C. F.).
Der praktische Autogen-Schweisser. Basel, Schweiz,
 Acetylen-Verein. 1 Band, 224 Seiten und 184 Abbildun-
 gen. (Preis : 3 R.M.)

1936 **621 .8**
KYSER (H.).
**Die elektrische Kraftübertragung. Dritter Band : Bau
 und Betrieb des Kraftwerkes.**
 Berlin, Julius Springer. 1 Band, 573 Seiten. (Preis :
 45 R.M.)

1937 **62. (01) & 669**
MAIER (A. F.).
**Einfluss des Spannungszustandes auf das Formän-
 derungsvermögen der metallischen Werkstoffe.**
 Berlin, V.D.I. Verlag. 1 Band. (Preis : 5 R.M.)

1936 **536**
SCHMIDT (E.).
Einführung in die technische Thermodynamik.
 Berlin, Julius Springer. 1 Band, 314 Seiten, 182 Ab-
 bildungen und 2 Dampftafeln. (Preis : 15 R.M.)

(1) The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress conjointly with the Office Bibliographique International, of Brussels. (See "Bibliographical Decimal Classification as applied to Railway Science", by L. WEISSENBRUCH, in the number for November 1897, of the *Bulletin of the International Railway Congress*, p. 1509).

1937 **62. (02)**
STÜCKLE (R.).
Uhlands Ingenieur-Kalender 1937.
 Leipzig, Alfred Körner. 1. Teil : 1. Taschenbuch, 279 Seiten. 2. Teil : Für den Konstruktionstisch, 1 086 Seiten. (Preis : 5.80 R.M.)

1937 **624. (06)**
 Vorbericht zum II. Kongress der Internationalen Vereinigung für Brückenbau und Hochbau.
 Berlin. Wilhelm Ernst & Sohn. 1 Band, 1 600 Seiten und 1 075 Textabbildungen. (Preis : 30 R.M.)

In English.

1936 **385. (08 (.942))**
Annual report of the South Australian Railways Commissioner for the year 1935-36.
 Adelaide. Frank Trigg, Government Printer, North Terrace.

1936 **62. (01 & 621 .83)**
BLACK (P. H.).
An investigation of relative stresses in solid spurs by the photoelastic method.
 Urbana : University of Illinois. (Price : 40 cents.)

1937 **536**
CHO-LAN YIN (Professor).
Steam internal energy-pressure chart.
 Peiping, China : Department of Mechanical Engineering, National Tsing Hua University.

1937 **536**
CHO-LAN YIN (Professor).
Steam pressure-entropy diagram.
 Peiping, China : Department of Mechanical Engineering, National Tsing Hua University.

1936 **621. (093 (.485))**
Det 2 000 de Lokomotivet. A Jubilee publication commemorating the delivery of the 2 000th locomotive.
 Trollhättan : Nydqvist & Holm Aktiebolag.

1936 **621 .43**
Diesel application plan book. Industrial, Marine Transportation, Aviation. Fabricoid (9 × 12 in.) pp. 296 ; blueprints, halftones.
 New York : Diesel Engines, Inc. (Price : \$ 5.00.)

1937 **385. (08 (.54))**
Eighty-second report of the Directors of the Bengal & North Western Railway Company, Limited, January, 1937, for the year ended 30th September, 1936.
 London : Waterlow & Sons Limited.

1937 **385. (08 (.54))**
Eighty-third report of the Directors of the Rohilkund & Kumaon Railway Company, Limited, January, 1937, for the year ended 30th September, 1936.
 London : Spottiswoode, Ballantyne & Co Ltd.

1936 **621 .43**
HELDT (P. M.).
High-speed Diesel engines. Second edition.
 London : Iliffe and Sons, Limited. (Price : 22 s. 6 d. net.)

1937 **621 .39**
HELSEBY (C.), HAMANN (C. W.) and SAMUEL (F. J.).
The welding and cutting year-book, 1936-37.
 London : The Temsbank Publishing Co, Ltd. 12, Whitehall, S.W.1. (8 1/4 in. × 5 1/4 in.) 244 pp. Illustrated. Paper covers. (Price : 5 sh. net.)

1937 **656 .22 (.73)**
HILDEBRAND (J. R.).
Trains of today and tomorrow.
 Washington : National Geographic Magazine, issue of November 1936.

1936 **385. (093 (.42))**
LEWIN (H. G.).
The Railway Mania and its aftermath, 1845-1852 (Being a sequel to « Early British Railways »).
 London : Offices of the « Railway Gazette ». (Price : 12 sh. net.)

1936 **62. (01)**
MOORE (H. F.).
Correlation between metallography and mechanical testing.
 Urbana : University of Illinois. (Price : 20 cents.)

1937 **621 .116 (02)**
Oldenbourg's practical charts of steam and boiler operation.
 London : The Technical Press, Limited. (Price : 7 sh., 6 d.)

1936 **625 .7 (06 (.73))**
Papers presented at the twenty-third annual conference on highway engineering, held at the University of Illinois, February 26-28, 1936.
 Urbana : University of Illinois. (Price : 50 cents.)

1936 **624. (06 (∞))**
Publications of the International Association for Bridge and Structural Engineering. — Fourth volume, 1936. Paper ; (7 × 9 1/2 in.) pp. 651 ; halftones, linecuts, tables.
 Zurich : The General Secretariat. (Price : 30 Swiss fr.)

1936 **385. (08 (.68))**
Report of the General Manager of the South African Railways and Harbours, for the year ended 31st March, 1936.
 Pretoria, Union of South Africa Government printer. (Price : 7 sh. 6 d.)

1936 **624. (06 (∞))**
Second Congress of the International Association for Bridge and Structural Engineering. Oct. 1-11, 1936. Cloth ; (7 × 9 1/2 in.) pp. 1582 ; halftones, linecuts, tables.
 Berlin : Wilhelm Ernst & Sohn. (Price : 25.50 R.M.)

1937 **536**
YOUNG (V. W.) and YOUNG (G. A.).
Elementary engineering thermodynamics.
 London : Mc Graw-Hill Publishing Company, Limited. (Price : 15 sh.)

[016.385. (05)]

II. — PERIODICALS.

In French.

Annales des Mines. (Paris.)

1936 **621 .118**
 Annales des Mines, juin, p. 314.
Accidents d'appareils à vapeur survenus pendant l'année 1933. (2 000 mots.)

Annales des ponts et chaussées. (Paris.)

1936 **624 .2**
 Annales des ponts et chaussées, septembre, p. 295.
MANDEL. — Flambage au sein d'un milieu élastique. (1 000 mots.)

1936 **656 .211.7 (.44)**
 Annales des ponts et chaussées, septembre, p. 336.
DELATTRE (A.). — Le poste d'accostage des ferries au port de Dunkerque. (10 000 mots & fig.)

1936 **624**
 Annales des ponts et chaussées, septembre, p. 387.
VALLETTE. — Etude sur les vieux tabliers en fer. (3 000 mots & fig.)

Bulletin de la Société d'encouragement pour l'industrie nationale. (Paris.)

1936 **669 .1**
 Bulletin de la Société d'encouragement pour l'industrie nationale, décembre, p. 677.
CASTRO (R.). — L'oxygène dans l'acier. (8 200 mots.)

Bulletin des transports internationaux par chemins de fer. (Berne.)

1937 **656 .223.2**
 Bulletin des transports internationaux par chemins de fer, janvier, p. 5.
PETRORO (L.). — La réglementation juridique internationale du transport des wagons de particuliers. (1 700 mots.)

1937 **313 .385 (.493)**
 Bulletin des transports internationaux par chemins de fer, janvier, p. 44.
La Société Nationale des Chemins de fer belges pendant les exercices 1934 et 1935. (500 mots.)

Bulletin technique de la Suisse romande. (Vevey.)

1937 **721 .9**
 Bulletin technique de la Suisse romande, n° 1, 2 janvier, p. 2 ; n° 2, 16 janvier, p. 14.
PARIS (A.). — Mise en tension préalable des armatures du béton armé. Son principe, son calcul et ses applications. (4 900 mots & fig.) (A suivre.)

1937

669 .1

Bull. techn. de la Suisse romande, p. 10.

Définition et interprétation des caractéristiques des aciers spéciaux. (2 100 mots.)

Chronique des transports. (Paris.)

1936 **385 .13 (.44)**
 Chronique des transports, n° 24, 25 décembre, p. 2.

La réforme fiscale, la loi de finances et les compagnies de chemins de fer. (3 800 mots.)

1937 **621 .43 (.44)**
 Chronique des transports, n° 1, 10 janvier, p. 9.

Les résultats de l'exploitation des automotrices en France. (3 000 mots.)

Génie civil. (Paris.)

1937 **624 .51 (.44)**
 Génie civil, n° 2838, 2 janvier, p. 1.

LEINEKUGEL LE COCQ (G.). — Les nouveaux ponts de Mornay-sur-Allier et la technique nouvelle de la construction des ponts suspendus. (5 000 mots & fig.)

1937 **62. (01 & 69)**
 Génie civil, n° 2838, 2 janvier, p. 7.

PIGEAUD (G.). — Lois d'endurance et coefficients de sécurité dans les constructions métalliques soumises à des efforts variables. (7 000 mots.) (A suivre.)

1937 **669 .1**
 Génie civil, n° 2838, 2 janvier, p. 11.

SEIGLE (J.). — Les divers états des aciers ordinaires recuits, trempés, hypertrempés et états intermédiaires, d'après les diagrammes dilatométriques au refroidissement. (3 400 mots & fig.)

1937 **62. (01 & 721 .9)**
 Génie civil, n° 2839, 9 janvier, p. 35.

PIGEAUD (G.). — Lois d'endurance et coefficients de sécurité dans les constructions métalliques soumises à des efforts variables. (4 600 mots & fig.)

1937 **669**
 Génie civil, n° 2839, 9 janvier, p. 42.

Les récents progrès de la microscopie métallographique. (2 000 mots & fig.)

1937 **621 .132.8 (.73) & 621 .43 (.73)**
 Génie civil, n° 2839, 9 janvier, p. 44.

Locomotive Diesel-électrique de l'Illinois Central Railroad (Etats-Unis). (900 mots & fig.)

1937 **62. (01)**
 Génie civil, n° 2840, 16 janvier, p. 61.

DOUCET (E.). — La représentation des moments et des produits d'inertie par le « cercle d'inertie ». (2 200 mots & fig.)

L'Allègement dans les Transports. (Lucerne.)

1936 **625 .234**
L'Allègement dans les transports, novembre-décembre.
p. 142.

BILEK (J.). — **Chauffage électrique** de remorques d'automotrices, sur la base d'isolation et de distribution réglable de la chaleur accumulée. (1 700 mots & fig.)

1936 **625 .5 (.494)**
L'Allègement dans les transports, novembre-décembre.
p. 148.

HAEFNER (C.). — Transformation et augmentation de la capacité du téléférique de Beckenried-Klewenalp. (1 500 mots & fig.).

1936 **625 .211**
L'Allègement dans les transports, novembre-décembre,
p. 154.

KREISSIG (E.). — La poutre close dans la construction du matériel roulant. (3 000 mots & fig.) (A suivre.)

1937 **621 .4 (.437)**
L'Allègement dans les transports, janvier-février, p. 2.

KOLLER (P.). — Nouvelle automotrice « Slovenska Strela » des Chemins de fer tchécoslovaques. (1 500 mots & fig.).

1937 **625 .211**
L'Allègement dans les transports, janvier-février, p. 16.

KREISSIG (E.). — La poutre close dans la construction du matériel roulant. (1 700 mots & fig.) (Fin.)

L'Ingénieur-Constructeur. (Paris.)

1936 **62. (01 & 691)**
L'Ingénieur-Constructeur, novembre-décembre, p. 138.

GUERRIN (A.). — L'effort tranchant et le glissement longitudinal considérés dans leur action sur la tenue des pièces en béton armé. (3 800 mots & fig.)

L'Ossature métallique. (Bruxelles.)

1937 **624 .8 (.73)**
L'Ossature métallique, janvier, p. 19.

Pont-rail basculant entièrement soudé. (700 mots & fig.)

1937 **621 .132.8**
L'Ossature métallique, janvier, p. 23.

DE WULF (G.). — Une nouvelle réalisation de la locomotive Franco. (400 mots & fig.)

1937 **624 .92 & 665 .882**
L'Ossature métallique, janvier, p. 26.

ANCION (G.). — Charpentes métalliques construites par soudure oxy-acétylénique. (1 300 mots & fig.)

Revue universelle des Mines. (Liège.)

1937 **621 .43 & 662**
Revue universelle des mines, janvier, p. 24.

JACOVLEFF (D. V.). — Combustibles pour moteurs Diesel rapides. (5 300 mots & fig.) (A suivre.)

Traction nouvelle. (Paris.)

1937 **621**
Traction nouvelle, janvier-février, p. 2.

REDSLOB (A.). — Les automotrices de Dietrich (5 500 mots & fig.)

1937 **621 .132.8 (.65) & 621 .43 (**
Traction nouvelle, janvier-février, p. 11.

Les locomotives Diesel-électriques des Chemins de fer algériens. (1 400 mots & fig.)

1937 **621 .43 (**
Traction nouvelle, janvier-février, p. 14.

LISSACQ. — Le centre d'autorails de Bordeaux. (1 100 mots & fig.)

1937 **621 .335 (**
Traction nouvelle, janvier-février, p. 16.

Nouvelles automotrices électriques. (3 000 mots & fig.)

1937 **621 .43 (**
Traction nouvelle, janvier-février, p. 20.

CUTTICA (A.). — Les autorails des Chemins de fer de l'Etat italien. (4 000 mots & fig.)

1937 **621 .43 (.4**
Traction nouvelle, janvier-février, p. 38.

LEINER (J.). — La transmission mixte mécanique électrique de la « Flèche Slovaque ». (1 200 mots & fig.)

In German.

Die Lokomotive. (Wien.)

1937 **621 .132.6 (.4**
Die Lokomotive, Januar, S. 1.

SEIDL (O.). — 2-C-2 Heissdampf-Schnellzugstenglokomotive Reihe 729 der Österreichischen Bundesbahnen (2. Lieferung). (2 000 Wörter & Abb.)

Die Reichsbahn. (Berlin.)

1936 **385 .1 (**
Die Reichsbahn, Heft 52/53, 23.30. Dezember, S. 11.

BUSCH. — Probleme der Finanzwirtschaft der Deutschen Reichsbahn. (13 500 Wörter.)

1936 **385. (09 (.4**
Die Reichsbahn, Heft 52/53, 23.30. Dezember, S. 11.

Die Deutsche Reichsbahn im Jahre 1936. Vorläufiger Jahresrückblick. (30 000 Wörter.)

Glaser's Annalen. (Berlin.)

1936 **621 .133**
Glaser's Annalen, Heft 12, 15. Dezember, S. 157.

KINKELDEI (L.). — Krümmungseinstellung der Führungsdricke und Krümmungswiderstand von Lokomotiven mit Drehgestellen, nach dem Druckrollenverfahren berechnet. (4 000 Wörter, 2 Zahlentafeln & Abb.)

1936 **621 .132.8**
 Glaser's Annalen, Heft 12, 15. Dezember, S. 162.
 GOTSCHLICH. — Verwendung von **Anthrazit-** und **Holzgastriebwagen** in einem Eisenbahnbetriebe. (2 200 Wörter & 3 Tafeln.)

1937 **656 .1 (.43)**
 Glaser's Annalen, Heft 1, 1. Januar, S. 1.
 Lösung der Beuth-Aufgabe 1936. **Schnellreisewagen** für den Personendienst der Reichsbahn auf den Reichsautobahnen. (7 000 Wörter & Abb.) (Schluss folgt.)

Organ für die Fortschritte des Eisenbahnwesens. (Berlin.)

1937 **625 .154**
 Organ für die Fortschr. des Eisenbahnw. Heft 1, 1. Januar, S. 1.
 FIEDLER. — Fundamentlose **Drehscheiben**. (3 800 Wörter, 2 Tafeln & Abb.)

1937 **625 .14 (01 & 625 .144.2**
 Organ für die Fortschr. des Eisenbahnw. Heft 1, 1. Januar, S. 7.
 FEYL (E.). — Steifigkeit des **Oberbaues**, Verschleiss und Krümmungswiderstand. (3 500 Wörter & Abb.)

1937 **621 .134.2**
 Organ für die Fortschr. des Eisenbahnw. Heft 2, 15. Januar, S. 19.
 MULLER (W.). — Tafeln zur Berechnung der Steuerung von **Dampflokomotiven**. (9 400 Wörter & Abb.)

Zeitschrift des Vereines Deutscher Ingenieure. (Berlin.)

1936 **536**
 Zeitsch. des Ver. Deutsch. Ing. Nr. 52, 26. Dezember, S. 1549.

SCHMIDT (E.). — Fortschritte der **wärmetechnischen Forschung**. (6 000 Wörter & Abb.)

1937 **621 .43 & 662**
 Zeitsch. des Ver. Deutsch. Ing. Nr. 2, 9. Januar, S. 37.
 HEINZE (R.) & MARDER (M.). — Zweckmässige Arbeitsweise zur Herstellung von **Dieseldkraftstoffen**. (700 Wörter & Abb.)

1937 **621 .9**
 Zeitsch. des Ver. Deutsch. Ing. Nr. 3, 16. Januar, S. 57.
 OPITZ (H.). — Leistungsmessungen an **Werkzeugmaschinen**. (5 300 Wörter & Abb.)

1937 **62. (01 & 694**
 Zeitsch. des Ver. Deutsch. Ing. Nr. 3, 16. Januar, S. 64.
 KOLLMANN (F.). — **Holzprüfung**. (6 200 Wörter & Abb.)

Zeitschrift für das gesamte Eisenbahn- Sicherungswesen. (Berlin.)

1937 **656 .25 (.481)**
 Zeitsch. für das ges. Eisenb.-Sicherungsw. Nr. 1, 10. Januar, S. 4.

DIEHL. — Die **Sicherungsanlagen** der norwegischen Staats-Eisenbahnen. (3 400 Wörter & Abb.)

1937 **656 .257**
 Zeitsch. für das ges. Eisenb.-Sicherungsw. Nr. 1, 10. Januar, S. 10.

ZIMMERMANN (O.). — Fernbedienung von **Blockwerken**. (2 700 Wörter & Abb.)

Zeitung des Vereins mitteleuropäischer Eisenbahnverwaltungen. (Berlin.)

1936 **385 .517.6 (.43)**
 Zeitung des Ver. mitteleurop. Eisenbahnverw. Nr. 52, 24. Dezember, S. 1031.

NIEDERSTADT. — Neuorganisation des deutschen **bahnärztlichen Dienstes**. (2 800 Wörter.)

1936 **385 .13 (.43)**
 Zeitung des Ver. mitteleurop. Eisenbahnverw. Nr. 52, 24. Dezember, S. 1034.

HÖLL. — Durchführung der Besteuerung im **Güterfernverkehr** und **Werkfernverkehr**. (6 500 Wörter.)

1936 **385 .15 (.494)**
 Zeitung des Ver. mitteleurop. Eisenbahnverw. Nr. 53, 31. Dezember, S. 1049.

WANNER (F.). — Der vom Bundesrat am 24. November verabschiedete Entwurf eines neuen **Schweizerischen Staatsbahn-Grundgesetzes**. (6 500 Wörter.)

1937 **385. (09 (.43)**
 Zeitung des Ver. mitteleurop. Eisenbahnverw. Nr. 1, 7. Januar, S. 1.; Nr. 2, 14. Januar, S. 21.

Rückblick auf das Jahr 1936. (29 000 Wörter.) (Fortsetzung folgt.)

In English.

Bulletin, American Railway Engineering Association. (Chicago, Ill.)

1936 **625 .12 (.73)**
 Bull. American Ry. Engineering Assn, October, p. 163.
 Report of Committee I. — **Roadway**. Physical properties of earth materials. Specifications for cast iron culvert pipe. Roadway protection, particularly concrete slab roadbed, signs, particularly roadway signs required. Etc... (9 000 words & fig.)

1936 **624 .31 (.73)**
 Bull. American Ry. Engineering Assn, October, p. 183.
 Report of Committee VII. — **Wood bridges and trestles**. Bearing power of wood piles. Recommended

relationships between the energy of hammer and the weight or mass of pile for proper driving, including concrete piles. Improved design of timber structures to give longer life with lower cost of maintenance. Etc... (2 000 words & fig.)

1936 **347 .75 (.73)**
Bull. American Ry. Engineering Asson, October, p. 187.

Report of Committee XX. — **Uniform general contract forms.** Form of agreement for cab stand and baggage transfer privileges. (1 800 words.)

1936 **625 .141 (.73)**
Bull. American Ry. Engineering Asson, October, p. 191.

Report of Committee II. — **Ballast.** Revision of manual specifications for stone ballast. Proper depth of ballast; Los Angeles testing machine. Design of ballast sections in line with present-day requirements. (2 500 words, tables & fig.)

1936 **656 .25 (.73)**
Bull. American Ry. Engineering Asson, October, p. 205.

Report of Committee X. — **Signals and interlocking.** Developments in railway signaling. Principal current activities of the signal section, A.A.R. (4 000 words & fig.)

Engineer. (London.)

1936 **621 .137**
Engineer, N° 4224, December 25, p. 680.

SAMS (J. G. B.). — **Long-distance locomotive operation overseas.** (1 900 words & fig.)

1936 **621 .33 (.438)**
Engineer, N° 4224, December 25, p. 692.

Electrification of the Polish State Railways. (1 000 words & fig.)

1937 **624**
Engineer, N° 4225, January 1, p. 4.
Roads, bridges and tunnels in 1936 (4 800 words & fig.)

1937 **621 .13**
Engineer, N° 4225, January 1, p. 13.
Locomotives in 1936. (1 300 words & fig.)

1937 **621 .43**
Engineer, N° 4225, January 1, p. 25.
Oil engine rail traction in 1936—I. (3 500 words & fig.) (*To be continued.*)

1937 **621 .33**
Engineer, N° 4225, January 1, p. 27.
Electrical engineering in 1936. (2 200 words & fig.) (*To be continued.*)

1937 **627**
Engineer, N° 4226, January 8, p. 34.
Harbours and waterways in 1936. N° 1 (4 500 words & fig.) (*To be continued.*)

1937 **621**
Engineer, N° 4226, January 8, p. 35.
Electrical engineering in 1936 (6 000 words & fig.)

1937 **621**
Engineer, N° 4226, January 8, p. 40.
Oil engine rail traction in 1936—II. (4 200 words & fig.) (*To be continued.*)

1937 **6**
Engineer, N° 4227, January 15, p. 66.
HILL (Sir Leonard). — **Air conditioning** (4 500 words & fig.)

1937 **6**
Engineer, N° 4227, January 15, p. 67.
Harbours and waterways in 1936. N° II (4 300 words & fig.)

1937 **621 .132.3 (.7)**
Engineer, N° 4227, January 15, p. 73.
Canadian National Railways **giant locomotive.** (1 000 words & fig.)

1937 **621**
Engineer, N° 4227, January 15, p. 83.
Oil engine rail traction in 1936—III. (2 200 words & fig.)

1937 **621**
Engineer, N° 4227, January 15, p. 86.
BAILEY (E. G.), SMITH (A. R.) and DICKINSON (P. S.). — **The steam locomotive.** (5 000 words & fig.)

1937 **6**
Engineer, N° 4228, January 22, p. 94.
The principles and practice of automatic control— (3 800 words & fig.) (*To be continued.*)

1937 **621 .1**
Engineer, N° 4228, January 22, p. 107.
The locomotive and its boiler. (1 700 words.)

1937 **385. (0)**
Engineer, N° 4228, January 22, p. 109.
Obituary. — **Sir John Aspinall.** (2 500 words & fig.)

1936 **625 .143.2 (.73) & 625 .143.3 (.7)**
The Metallurgist, p. 179, supplement to the Engineer December 25.
Fissures in railroad rails. (1 300 words.)

1936 **62. (01 & 669)**
The Metallurgist, p. 186, supplement to the Engineer December 25.
The phosphate rust-proofing process. (1 400 words.)

1936 **62. (01 & 6)**
The Metallurgist, p. 188, supplement to the Engineer December 25.
Hardness testing. (1 800 words & fig.)

Engineering. (London.)

1936 **621 .43 & 621 .8**

Engineering, N° 3701, December 18, p. 665.

The Hobbs transmission for motor vehicles. (3 600 words & fig.)

1936 **621. (06 .42) & 656 .221**

Engineering, N° 3701, December 18, p. 679.

JOHANSEN (F. C.). — The air-resistance of passenger trains. (3 400 words & tables.)

1936 **621 .33 (.438)**

Engineering, N° 3702, December 25, p. 696.

The electrification of the Warsaw Suburban Railways. (750 words.)

1936 **621 .132.8 (.485) & 656 .222.1 (.485)**

Engineering, N° 3702, December 25, p. 697.

Performance of the Ljungström non-condensing turbine locomotive. (350 words.)

1936 **01. (06**

Engineering, N° 3702, December 25, p. 711.

BRADFORD (Dr. S. C.). — Conference of the International Institute of Documentation held at The Hague from August 11 to 15, 1936. (1 900 words.)

1937 **62. (01 & 721 .1**

Engineering, N° 3703, January 1, p. 10.

The Kjellman soil-testing machine. (1 400 words & fig.)

1937 **621 .133.3 & 621 .133.4**

Engineering, N° 3703, January 1, p. 16.

The locomotive front end. (1 400 words.)

1937 **621 .43 & 621 .8**

Engineering, N° 3704, January 8, p. 29.

COUSINS (R. J. W.). — Flexible couplings for diesel engines. (3 500 words & fig.)

1937 **624 .2 (.42)**

Engineering, N° 3704, January 8, p. 36.

Tests of Callender-Hamilton unit-construction bridge. (2 700 words & fig.)

1937 **621 .43**

Engineering, N° 3704, January 8, p. 45.

Oil-engine traction in 1936. (3 000 words.) (*To be continued.*)

1937 **621 .131.4**

Engineering, N° 3704, January 8, p. 49.

The Eimco-Finlay shovelling loader. (1 100 words & fig.)

1937 **669 .1**

Engineering, N° 3704, January 8, p. 53.

ABRAM (H. H.). — The influence of vanadium on nickel-chromium and nickel-chromium-molybdenum steels. (1 300 words.)

1937

Engineering, N° 3705, January 15, p. 78.

THANHEISER (G.). — Determination of gases in steel by the hot-extraction method. (6 400 words & tables.)

1937

621 .1 (0

Engineering, N° 3706, January 22, p. 85.

BROWNLIE (D.). — High steam pressures. (3 700 words & fig.)

1937

624 .2

Engineering, N° 3706, January 22, p. 95.

The pre-stressing of bridge girders. (2 200 words.)

1937

621 .43

Engineering, N° 3706, January 22, p. 107.

WRIGHT BAKER (H.). — Piston temperatures in a sleeve-valve oil engine. Paper read before the Institution of Mechanical Engineers, Internal Combustion Engine Group, on Friday, January 15. Abridged. (4 500 words.) (*To be continued.*)

Engineering News-Record. (New York.)

1936

625 .111 (.73)

Engineering News Record, N° 26, December 24, p. 881.

New-York Central elevates five miles of track through Syracuse. (6 500 words & fig.)

Journal, Institute of Transport. (London.)

1937

621 .33 (.42)

COX (E. C.). — The progress of the Southern Railway electrification. (12 000 words.)

1937

656 (.42)

HANDOVER (D. H.). — Some aspects of the organisation of Empire air services. (8 000 words & fig.)

Journal, Institution of Civil Engineers. (London.)

1937

624 .32 (.67)

Journal, Institution of Civil Engineers, January, p. 325

HANDMAN (F. W. A.). — The lower Zambezi bridge. (13 000 words, tables & fig.)

1937

624 .32 (.67)

Journal, Institution of Civil Engineers, January, p. 369.

HOWORTH (G. E.). — The construction of the lower Zambezi bridge. (18 000 words, tables & fig.)

1937

627

Journal, Institution of Civil Engineers, January, p. 423.

CARPMAN (R.). — The maintenance of waterways to Harbours and Docks. (20 000 words, tables & fig.)

1937

625 .111 (.42)

Journal, Institution of Civil Engineers, January, p. 469.

SLADE (F. W.). — The diversion of the main line between Mottram and Dinting, London and North Eastern Railway. (4 000 words & fig.)

Modern Transport. (London.)

- 1936** 347 .763 (.42)
Modern Transport, N° 928, December 26, p. 3.
Transport Bills in Parliament. — Proposals of the Railways and Municipalities. (1 700 words.)
- 1936** 621 .132.3 (.42)
Modern Transport, N° 928, December 26, p. 5.
Modification of L.M.S. locomotives. — Class 5 and 5 X passenger engines. (500 words & fig.)
- 1937** 656 (.54)
Modern Transport, N° 929, January 2, p. 3.
COLAM (H. N.). — Road and rail transport in India. (1 700 words.)
- 1937** 656 (.43)
Modern Transport, N° 929, January 2, p. 4.
BRANT (E. D.). — Transport in Germany. (1 800 words.)
- 1937** 656 .23 (.42)
Modern Transport, N° 929, January 2, p. 7.
Transport and the user. Discussion at Institute of Transport. (1 800 words.)
- 1937** 621 .132.1
Modern Transport, N° 929, January 2, p. 10.
Locomotives of 1936. (200 words & fig.)
- 1937** 621 .43
Modern Transport, N° 929, January 2, p. 15.
Diesel locomotives in 1936. (100 words & fig.)
- 1937** 656 .212.5
Modern Transport, N° 930, January 9, p. 4.
BARRINGTON-WARD (V. M.). — Goods traffic working. (1 500 words.)
- 1937** 625 .244 (.42)
Modern Transport, N° 930, January, p. 5.
Food conveyance on L.M.S.R. — New insulated vans. (600 words.)
- 1937** 388. ((42)
Modern Transport, N° 931, January 16, p. 3.
North-East London Railway improvements. (1 400 words & one map.)
- 1937** 621 .133.7 (.94)
Modern Transport, N° 931, January 16, p. 4.
Treatment of water for locomotives. (700 words.)
- 1937** 621 .43 (.43)
Modern Transport, N° 931, January 16, p. 4.
Diesel observation railcars. (400 words & fig.)
- 1937** 656
Modern Transport, N° 931, January 16, p. 7.
DELANNEY (L.). — Co-ordination of road and rail transport. An international survey. (2 500 words.)

- 1937** 621 .13 (0 & 656 .222
Modern Transport, N° 932, January 23, p. 3.
GRESLEY (Sir Nigel). — Extra high-speed train operation. Problems of inception and design. (1 500 words.)
- 1937** 385 .11 (.6
Modern Transport, N° 932, January 23, p. 4.
Railway progress in South Africa. (1 500 words.)
- 1937** 621 .43 (.4
Modern Transport, N° 932, January 23, p. 5.
More railcars for Northern Ireland. (1 200 words & fig.)
- 1937** 656 .23 (.42
Modern Transport, N° 932, January 23, p. 6.
SEWELL (A. E.). — Competition in freight transport. (2 500 words.)
- Proceedings, Institution of Mechanical Engineers (London.)**
- 1936** 621 .392 (06 (.42
Proceedings, Institution of Mechanical Engineers, Vol. 133, April-November, p. 5.
Welding research committee, second report and discussion. (32 000 words, tables & fig.)
- 1936** 621. (06 (.42) & 656 .222
Proceedings, Institution of Mechanical Engineers, Vol. 133, April-November, p. 251.
GRESLEY (Sir H. Nigel). — President's address. (5 000 words & fig.)
- 1936** 62. (01 & 621 .39
Proceedings, Institution of Mechanical Engineers, Vol. 133, April-November, p. 295.
BOULTON (N. S.) and LANCE MARTIN (H. E.). — Residual stresses in arc-welded plates. (18 000 words, tables & fig.)
- 1936** 621 .8
Proceedings, Institution of Mechanical Engineers, Vol. 133, April-November, p. 349.
ABBOTT (W.). — Worm gear contacts. (16 500 words, tables & fig.)
- 1936** 621 .8
Proceedings, Institution of Mechanical Engineers, Vol. 133, April-November, p. 413.
THOMSON (A. S. T.). — Investigations in film lubrication. (17 000 words & tables.)
- 1936** 621 .
Proceedings, Institution of Mechanical Engineers, Vol. 133, April-November, p. 473.
HERBERT (Sir Alfred). — Machine tools. (7 200 words, tables & fig.)
- 1936** 6
Proceedings, Institution of Mechanical Engineers, Vol. 133, April-November, p. 499.
CAMERON (D. E.). — Maintenance management. (3 000 words & tables.)

1936 **669 .1**
 Proceedings, Institution of Mechanical Engineers, Vol. 133, April-November, p. 515.
WOLSTENHOLME (G. E.). — The choice of steels for particular purposes. (1 200 words & tables.)

1936 **62. (01 & 669 .1**
 Proceedings, Institution of Mechanical Engineers, Vol. 133, April-November, p. 533.
ONslow (D. V.). — Notes of the research being carried out by the British Electrical and Allied Industries Research Association on the creep and corrosion of steels for use at high temperatures. (2 200 words.)

Railway Age. (New York.)

1936 **621 .132.5 (.73)**
 Railway Age, N° 25, December 19, p. 900.
A powerful high-speed freight locomotive. (2 300 words & fig.)

1936 **656 .254 (.73) & 656 .257 (.73)**
 Railway Age, N° 25, December 19, p. 904.
Modern centralized control-type interlocking at Syracuse, New York Central. (2 400 words & fig.)

1936 **725 .34 (.73)**
 Railway Age, N° 25, December 19, p. 907.
Constructs pier shed with frame of 90-lb scrap rails. (2 800 words & fig.)

1936 **625 .24 (.73) & 625 .27 (.73)**
 Railway Age, N° 25, December 19, p. 911.
Pennsylvania Railroad destroying 32 000 freight cars. (2 200 words & fig.)

1936 **621 .43 (.73)**
 Railway Age, N° 25, December 19, p. 919.
Diesel conversion of gasoline rail car. (600 words & fig.)

1936 **621 .43 (.73)**
 Railway Age, N° 26, December 26, p. 931.
Enlarged twin cities Zephyrs placed in service by Burlington. (3 800 words & fig.)

1936 **624. (.73) & 625 .13 (.73)**
 Railway Age, N° 26, December 26, p. 936.
HART (R. P.). — Meeting specific problems in bridge design. (2 600 words & fig.)

1936 **625 .3 (.72)**
 Railway Age, N° 26, December 26, p. 943.
Efficiently-operated Central American line. (1 200 words & fig.)

1936 **656 .1 (.73) & 656 .261 (.73)**
 Railway Age, N° 26, December 26, p. 948.
Express operations at New York (rail-highway coordination). (2 700 words & fig.)

1936 **621 .43 (.73)**
 Railway Age, N° 26, December 26, p. 951.
Arlington & Fairfax uses passenger auto-railers. (300 words & fig.)

1937 **385 .113 (.73)**
 Railway Age, N° 1, January 2, p. 4.
PARMELEE (Dr. G. H.). — A review of railway operations in 1936. (10 000 words & table.)

1937 **385 .1 (.73)**
 Railway Age, N° 1, January 2, p. 12.
HOWSON (E. T.). — The outlook for 1937. Larger programs, greater expenditures for new trains, improved equipment and better track feature plans to improve service and prepare for heavier business. (4 200 words & fig.)

1937 **656 .222.1 (.73)**
 Railway Age, N° 1, January 2, p. 16.
DOSTER (R. A.). — 1936. A year of outstanding traffic developments. (3 800 words & fig.)

1937 **385. (061.4 (.73)**
 Railway Age, N° 1, January 2, p. 21.
LAME (H. F.). — The second year of the Association of American Railroads. (5 400 words.)

1937 **313 : 625 .2 (.73)**
 Railway Age, N° 1, January 2, p. 25.
PECK (C. B.). — Reserves of equipment approach vanishing point (1 900 words, tables & fig.)

1937 **625 .1 (0 (.73)**
 Railway Age, N° 1, January 2, p. 28.
LACHER (W. S.). — Expenditures on fixed property are increasing. (3 200 words & tables.)

1937 **385 .1 (.71)**
 Railway Age, N° 1, January 2, p. 32.
Recovery under way in Canada. (4 000 words & fig.)

1937 **385 .1 (.725)**
 Railway Age, N° 1, January 2, p. 36.
Mexican Railways experience further gain in traffic. (1 900 words & fig.)

1937 **385 .1 (.73)**
 Railway Age, N° 1, January 2, p. 38.
LYNE (J. G.). — Financial outlook is improving. (2 000 words & tables.)

1937 **313 : 621 .139 (.73), 313 : 625 .18 (.73) & 313 : 625 .27 (.73)**
 Railway Age, N° 1, January 2, p. 45.
STEEL (D. A.). — \$ 350,000,000 increase in railway buying. (2 700 words, tables & fig.)

1937 **313 : 625 .1 (.71 + .73)**
 Railway Age, N° 1, January 2, p. 51.
BOYD (G. E.). — Railway construction shows signs of upturn (12 000 words, tables & fig.)

1937 313 : 621 .139 (.73), 313 : 625 .18 (.73)
 & 313 : 625 .27 (.73)

Railway Age, N° 1, January 2, p. 62.

STEEL (D. A.). — More increases in railway material costs in 1936. (7 500 words & tables.)

1937 313 : 621 .13 (.71 + .73)
Railway Age, N° 1, January 2, p. 70.

TAFT (W. J.). — Locomotives ordered in 1936.
(1 200 words, tables & fig.)

1937 313 : 625 .24 (.71 + .73)
Railway Age, N° 1, January 2, p. 73.

KRAEGER (F. W.). — Freight cars ordered in 1936.
(2 000 words, tables & fig.)

1937 **313 : 625 .23 (.71 + .73)**
Railway Age, N° 1, January 2, p. 79.

KRAEGER (F. W.). — Passenger-train cars ordered in 1936. (2 000 words, tables & fig.)

1937 313 : 656 .25 (.71 + .73)
Railway Age, No 1, January 2, p. 83.

DUNN (J. H.). — Signal construction increased during 1936 (5 500 words, tables & fig.)

1937 **313 : 656** .254 (.71 + .73)
 Railway Age, N° 1, January 2, p. 89.

PHILLIPS (E. J.). — Improved service is feature of 1936, T. & T. activity. (1700 words & tables.)

1937 313 : 656 .1 (.71 + .73)
Railway Age, N° 1, January 2, p. 91.

LAYNG (Ch.). — Widespread activity features motor transport year, (3 000 words & table.)

Railway Gazette. (London.)

1937 313. 625 .17 (.42)
Railway Gazette, N° 1, January 1, p. 14.

Aspects of permanent way maintenance (returns of the British main line railways). (2 800 words.)

1937 625 .2 (0)
Railway Gazette, N° 1, January 1, p. 19.

Resonance in rolling stock. (700 words.)

1937 621 .132.5 (.73)
Railway Gazette, N° 1, January 1, p. 20.

New single-expansion 2-6-6-4 type articulated locomotives, Norfolk & Western Railway. (1000 words & fig.)

1937 621 .9 (.42)
Railway Gazette, N° 1, January 1, p. 24.

Production of staybolts for locomotive boilers. (800 words & fig.)

1937 656 .256.3 (.492)
Railway Gazette, N° 1, January 1, p. 26.

Automatic signals on the Netherlands Railways.
(1 500 words & fig.)

1937 625 .5 (.8)
Railway Gazette, N° 2, January 8, p. 55.

Petropolis incline, Leopoldina Railway, Brazil. (20 words & fig.)

1937 621
 Railway Gazette, N° 2, January 8, p. 58.
 The machining of railway axles. (600 words & figs)

1937 621 .132.5 (5)
Railway Gazette, N° 2, January 8, p. 61.
New 2-8-2 locomotives, Canadian National Railway
(300 words & fig.)

1937 385 .581 (4)
 Railway Gazette, N° 2, January 8, p. 66.
 Locomotive Men's claim for a six-hour day. (48
 words.)

1937 388. (4)
Railway Gazette, N° 3, January 15, p. 92.
London passenger traffic pool. (900 words & map.)

1937 621.43 & 656
Railway Gazette, N° 3, January 15, p. 103.
Organisation of a Railway company's road motor
engineer's department—II. (3 000 words & fig.)

1937 621.132.5 (6)
Railway Gazette, N° 3, January 15, p. 113.
South African Railways 4-8-2 type locomotives (2
words & fig.)

1937 656 .21 (4)
Railway Gazette, N° 3, January 15. p. 120.
The working of Paddington passenger station. (12
words & fig.)

1937 621
 Railway Gazette, N° 3, January 15, p. 143.
 White bearing metals for heavy duty—I. (20
 words & fig.)

1937 621 .132.3 (4
Railway Gazette, N° 3, January 15, p. 145.
Streamlining a Nord Express locomotive. (500 words
& fig.)

1937	656 .222.1 (4
Railway Gazette, N° 3, January 15, p. 153.	
Remarkable French locomotive performances. (28 words.)	

1936	621 .43 (4)
Diesel Ry. Traction, p. 1084, Suppl. to the Ry. C zette, December 25.	
British boom in diesel traction. (900 words & fig.	

1936	621.43 & 621.44
Diesel Ry. Traction, p. 1087, Suppl. to the Ry. Gazette, December 25.	

Transmissions. Mechanical, hydraulic and electric systems show signs of standardisation. (500 words & figures)

- 1936** **621 .43 (.8)**
Diesel Ry. Traction, p. 1088, Supplt. to the Ry. Gazette, December 25.
- South America consolidates Diesel situation.** (1 000 words & fig.)
-
- 1936** **621 .43**
Diesel Ry. Traction, p. 1090, Supplt. to the Ry. Gazette, December 25.
- Progress in Diesel engine construction.** (1 200 words & fig.)
-
- 1936** **621 .43 (.4)**
Diesel Ry. Traction, p. 1092, Supplt. to the Ry. Gazette, December 25.
- European development ; powers of 90 to 4 000 b. h. p. and maximum speeds of 30 to 127 m. p. h. form range of diesel activities during 1936.** (900 words & fig.)
-
- 1936** **621 .43 (.45)**
Diesel Ry. Traction, p. 1094, Supplt. to the Ry. Gazette, December 25.
- Rapid advance of Italian Diesels.** (400 words & fig.)
-
- 1936** **621 .43 (.6)**
Diesel Ry. Traction, p. 1095, Supplt. to the Ry. Gazette, December 25.
- Healthy signs in Africa, Asia and Australia. — Railcar invasion of branch and suburban lines.** (500 words & fig.)
-
- 1936** **621 .43 (.73)**
Diesel Ry. Traction, p. 1097, Supplt. to the Ry. Gazette, December 25.
- SIMONS (R. L.). — Diesel traction in the U.S.A. — A review of progress in 1936.** (1 300 words & fig.)
-
- 1937** **621 .43 (.43)**
Diesel Ry. Traction, p. 106, Supplt. to the Ry. Gazette, January 22.
- STRAEBE: Railcar development on the German State Railways.** (2 400 words & fig.)
-
- 1937** **621 .43 (.73)**
Diesel Ry. Traction, p. 170, Supplt. to the Ry. Gazette, January 22.
- American streamlined train and locomotive news.** (800 words.)
-
- 1937** **621 .43 (.944)**
Diesel Ry. Traction, p. 171, Supplt. to the Ry. Gazette, January 22.
- British engines for Australia.** (600 words & fig.)
-
- 1937** **621 .43 (.42)**
Diesel Ry. Traction, p. 172, Supplt. to the Ry. Gazette, January 22.
- Small standard-gauge shunters.** (600 words & fig.)
-
- 1937** **625 .144 (.44)**
Diesel Ry. Traction, p. 173, Supplt. to the Ry. Gazette, January 22.
- A railcar turntable.** (300 words & fig.)
-
- 1937** **621 .43 (.73)**
Diesel Ry. Traction, p. 174, Supplt. to the Ry. Gazette, January 22.
- WORTH (D.). — Auxiliary Diesel power on the Denver Zephyrs.** (1 500 words & fig.)
-
- 1937** **385 .114 (.73) & 621 .43 (.73)**
Diesel Ry. Traction, p. 176, Supplt. to the Ry. Gazette, January 22.
- Operating experiences with the Burlington Zephyr.** (600 words & fig.)
-
- 1937** **621 .43 (.43)**
Diesel Ry. Traction, p. 177, Supplt. to the Ry. Gazette, January 22.
- A German standard horizontal engine** (300 words & fig.)
-
- 1937** **621 .43 (.44)**
Diesel Ry. Traction, p. 177, Supplt. to the Ry. Gazette, January 22.
- Diesel train activities, Northern Railway of France.** (300 words & fig.)
-
- 1937** **621 .43 (.42)**
Diesel Ry. Traction, p. 178, Supplt. to the Ry. Gazette, January 22.
- Diesel-mechanical locomotive for Air Ministry.** (800 words & fig.)
-
- 1937** **621 .33 (∞)**
Electric Railway Traction, p. 82, Supplt. to the Railway Gazette, January 8.
- Railway electrification in 1936.** (1 600 words & fig.)
-
- 1937** **621 .33 (.438)**
Electric Railway Traction, p. 85, Supplt. to the Railway Gazette, January 8.
- Electrification of Warsaw Suburban Lines.** (1 000 words & fig.)
-
- 1937** **621 .33**
Electric Railway Traction, p. 87, Supplt. to the Railway Gazette, January 8.
- Modern electrification notes.** (1 000 words.)
-
- Railway Magazine. (London.)**
-
- 1937** **656 .222 (.42)**
Railway Magazine, January, p. 1.
- LEE (Ch. E.) and « MERCURY ». — The evolution of Anglo-Scottish services.** (5 000 words & fig.) (*To be continued.*)
-
- 1937** **656 .222.1 (.42)**
Railway Magazine, January, p. 7.
- ALLEN (C. J.). — Four hundred miles at 70 miles an hour.** Glasgow to Euston in 5 hours 44 1/4 minutes. (3 900 words & fig.)

1937 **656 .222.1 (.42)**
 Railway Magazine, January, p. 14.
 ALLEN (C. J.). — **British locomotive practice & performance.** (5 700 words & fig.)

1937 **385. (091 (.42)**
 Railway Magazine, January, p. 27.
 NOCK (O. S.). — **The West Highland section of the L.N.E.R.** (5 300 words & fig.)

The Locomotive. (London.)

1937 **621 .132.3 (.44)**
 The locomotive, N° 533, January 15, p. 2.
Streamlined Pacific Locomotive N° 3. 1280, Northern Railway of France. (400 words & fig.)

1937 **621 .132.3 (.52)**
 The locomotive, N° 533, January 15, p. 3.
 « **Mikado** » locomotives, Japanese Government Railways (1 200 words & fig.)

1937 **621 .132.3 (.71)**
 The locomotive, N° 533, January 15, p. 6.
High-speed locos., Canadian Pacific Railway. (1 600 words & fig.)

1937 **625 .232 (.42 + .44)**
 The locomotive, N° 533, January 15, p. 10.
Sleeping cars for the Channel Ferry service. (500 words & fig.)

1937 **621 .392 (.42) & 625 .211**
 The locomotive, N° 533, January 15, p. 12.
Welded underframes for 12-ton covered wagons, L.M.S. Ry. (1 200 words & fig.)

1937 **625 .232 (.42)**
 The locomotive, N° 533, January 15, p. 14.
New suburban carriages, Great Southern Railways. (600 words & fig.)

1937 **625 .234 (.42)**
 The locomotive, N° 533, January 15, p. 16.
Carriage heating on the « Vapor » system. (1 000 words & fig.)

1937 **625 .232 (.51)**
 The locomotive, N° 533, January 15, p. 17.
All-steel coaches for the Canton-Hankow Railway, China. (1 600 words & fig.)

The Oil Engine. (London.)

1937 **621 .43**
 The Oil Engine, January, p. 264.
Diesel rail traction in 1936. (1 500 words & fig.)

1937 **621 .43 (.71)**
 The Oil Engine, January, p. 267.
5 400 B.H.P. Oil-engined trains. £ 1 200 000 worth new diesel rolling stock ordered in America, including the two largest and most powerful trains in the world (600 words.)

1937 **621 .43 (.48)**
 The Oil Engine, January, p. 267.
A 550 b. h. p. locomotive. (200 words & fig.)

1937 **621 .43 (.41)**
 The Oil Engine, January, p. 268.
 STROEBE. — **Oil-engined trains on the German Railways.** Complete success of diesel-engined units. Many new designs for express and branch-line services. New 1 300 b. h. p. engine. (1 400 words.)

1937 **621 .43 (.81)**
 The Oil Engine, January, p. 273.
 Eleven **British railcars for the Argentine.** (600 words & fig.)

1937 **621 .43 (.44) & 656 .22 (.41)**
 The Oil Engine, January, p. 285.
Remodelling railway operation by diesel trains. (600 words & fig.)

In Italian.

Annali dei lavori pubblici. (Roma.)

1936 **62. (01 & 02)**
 Annali dei lavori pubblici, dicembre, p. 947.
 GUIDI (C. C.). — **L'impiego dei modelli nelle ricerche sperimentali sulle costruzioni.** (10 000 parole & fig.)

1936 **624. (01 & 02)**
 Annali dei lavori pubblici, dicembre, p. 970.
 de SIMONE (D.). — **Il secondo congresso internazionale di ponti e grandi strutture.** (Berlino-Monaco 1-11 ottobre 1936). (11 600 parole.)

La tecnica professionale. (Firenze.)

1937 **621 .335 (.45)**
 La tecnica professionale, gennaio, p. 2.
 Dati e caratteristiche degli **elettrotreni E.T.R.** 203 206 P. S. (1 500 parole & fig.)

Rivista tecnica delle ferrovie italiane. (Roma.)

1936 **621 .335 (.45)**
 Rivista tecnica delle ferrovie italiane, 15 dicembre, p. 335.
 BIANCHI (G.). — **Gli elettrotreni serie E.T.R.** (13 000 parole & fig.)

1936

625 .5

Rivista tecnica delle ferrovie italiane, 15 dicembre, p. 387.

CAMOSSO (E.). — La verifica della stabilità delle funi nei progetti di funivie. (8700 parole, 6 tavole & fig.)

In Dutch.

De Ingenieur. (Den Haag.)

1937

62. (01 & 691

De Ingenieur, Nr. 1, 1 Januari, p. Bt. 1.

HUBER (E. A. F.). — De dimensioneering van constructies van **gewapend beton**, die onderworpen zijn aan buiging, gebaseerd op de afhankelijkheid tusschen kubusvastheid, drukspanning en elasticiteits modulus van het beton. (1000 woorden & 3 tabellen.)

Spoor- en Tramwegen. (Utrecht.)

1937

656 .254

Spoor- en Tramwegen, Nr. 1, 5 Januari, p. 2.

HUG (A. M.). — **Spoorwegtelefoonlijnen** met oproep-bij-keuze. (1600 woorden & fig.)

1937

625 .144.2

Spoor- en Tramwegen, Nr. 1, 5 Januari, p. 8.

Verbeteren van bogen door de verschuivingsmethode. (1500 woorden.)

1937

621 .43 (.492)

Spoor- en Tramwegen, Nr. 2, 19 Januari, p. 27.

HEYLIGERS (F. J.). — Electrische arbeidsoverdracht bij **Dieseltreinen**. (1700 woorden & fig.)

1937

656 .211.5

Spoor- en Tramwegen, Nr. 2, 19 Januari, p. 33.

DE HAAN (J. A.). — De **plaatskaartendruk machines** « Regina ». (2500 woorden & fig.)

In Portuguese.

Gazeta dos Caminhos de ferro. (Lisboa.)

1936

656. (.67)

Gazeta dos caminhos de ferro, N° 1176, 16 de dezembro, p. 591.

GALVAO (A. L.). — **Coordenação dos transportes** em Moçambique. (2700 palavras.)

1937

625 .144.2

Gazeta dos caminhos de ferro, N° 1177, 1 de janeiro, p. 14.

TAVARES DOS SANTOS (M.). — A via férrea moderna e os novos métodos de **rectificação das curvas**. (4000 palavras & fig.)

1937

621 .135.4 & 625 .215

Gazeta dos caminhos de ferro, N° 1177, 1 de janeiro, p. 20.

GALLO (J.). — Estudo das condições necessárias para conveniente **inscrição nas curvas**, do material circulante de dois e três rodados. (500 palavras & fig.)

MONTHLY BIBLIOGRAPHY OF RAILWAYS ⁽¹⁾.

PUBLISHED UNDER THE SUPERVISION OF

P. GHILAIN,

General Secretary of the Permanent Commission of the International Railway Congress Association.

(APRIL 1937)

[016.385. (02)]

I. — BOOKS.

In French.	In German.
1937 624. (06) Association Internationale des Ponts et Charpentes. Zurich, Gebr. Leeman & Co. 1 volume, 650 pages. Prix : 30 fr. suisses.)	1937 625 .1 (02) Elsners Taschenbuch für den bautechnischen Eisenbahndienst. Berlin, Otto Elsner Verlagsgesellschaft. 1 Band, 447 Seiten. (Preis : 2.50 R.M.)
1937 62. (02) LAUDEL (J.). Aide-mémoire des ingénieurs, architectes, entrepreneurs, conducteurs de travaux, agents-voyers, dessinateurs, etc. Paris, Dunod, 92, rue Bonaparte. 2 volumes (13 × 21), 296 pages et 1 640 figures. (Prix 95 fr. français.)	1936 62. (01) FOPPL (O.). Aufschaukelung und Dämpfung von Schwingungen. Berlin, Julius Springer. 1 Band, 121 Seiten und 72 Bildern. (Preis : 8.40 R.M.)
1937 691 AHIN (J.). Recueil de planches de béton armé. 1 brochure (27 × 42), 27 pages et 54 figures. (Prix : 26,65 fr. français.)	1936 691. (02 & 721 .9 (02) NEUMANN (E.). Handbuch für Eisenbetonbau, Strassen-, Eisenbahn-, Berg- und Tunnelbau. Berlin, Wilhelm Ernst und Sohn. 1 Band. (Preis : 5.30 R.M.)
1937 665 .882 ESLIER (R.). Documents sur les nouvelles méthodes de soudure autogène oxyacétylénique. Paris, Office central de l'Acétylène et de la Soudure autogène. 1 volume, 72 pages et figures. (Prix : 10 fr. français.)	1936 536 SCHMIDT (E.). Einführung in die technische Thermodynamik. Berlin, Julius Springer. 1 Band, 314 Seiten. (Preis : 15 R.M.)
1937 531. (02) AINLEVÉ (P.). Cours de mécanique. Paris, Gauthier-Villars. 2 volumes, 664 et 750 pages et 195 figures. (Prix : respectivement 100 et 140 fr. français.)	1937 62. (01 & 669 SEEGER (G.). Wirkung von Druckvorspannungen auf die Dauerfestigkeit metallischer Werkstoffe. Berlin, V. D. L. Verlag. 1 Band. (Preis : 5 R.M.)
1937 691 TERN (O.). La mesure systématique, moyen de calcul des propriétés du béton. Vienne, Société autrichienne des ingénieurs et des architectes. 1 brochure, 20 pages, 2 planches.	1936 621 .33 WECHMANN (W.). Das elektrische Eisenbahnwesen der Gegenwart. Berlin, Sozialpolitik, Wirtschaft und Statistik, G. m. b. H. 1 Band, 160 Seiten und 350 Bildern. (Preis : 8 R.M.)

(1) The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress conjointly with the Office Bibliographique International, of Brussels. (See "Bibliographical Decimal Classification as applied to Railway Science", by L. WEISSENBRUCH, in the number for November 1897, of the *Bulletin of the International Railway Congress*, p. 1509).

In English.

- 1936** **533**
BRADLEY (J.).
 Elements of practical aerodynamics.
 New York, John Wiley and Sons. (Price: 12 s. 6 d.)
- 1937** **62. (01 & 662**
HETZEL (T. B.).
 Diesel fuel testing. The development of diesel fuel testing.
 The Pennsylvania State College bulletin, N° 45, 1936.
 Paper 6 × 9 in. (59 pages, 29 fig., 9 tables). (Price : \$ 0.50.)
- 1937** **621 .8**
PARRY (E. L.).
 Manuel of power transmission.
 London, Trade and Technical Press, Ltd., 65, Chancery-Lane E. C. 4. (Price : 12 s. 6 d. net.)
- 1937** **621 .392**
 Procedure handbook of arc welding design and practice. Fourth edition.
 Welwyn Garden City : Lincoln Electric Company, Ltd. (Price: 8 s. 6 d. net.)
- 1937** **621 .43**
PURDAY (H. F.).
 Diesel engine design. Fourth edition.
 London, Constable and Co., Ltd., 10, Orange Street, W. C. 2. (Price: 24 s. net.)
- 1937** **656 .25 (06 (.73)**
 Signal Section Proceedings. (Association of American Railroads).
 New York, The Signal Section, A. A. R. (416 pages, fig. & tables.)

- 1937** **621**
TODD (R. W.) and THOMPSON (W. H.).
 Outdoor high-voltage switchgear.
 London, Sir Isaac Pitman and Sons, Ltd., Park Street, W. C. 2. (Price: 42 s. net.)
- 1937** **621 .13 (**
WARNER (P. T.).
 Historical locomotives.
 Moline (Illinois U. S. A.): Strombeck-Becker Mfg. (5 1/4 × 7 1/2 inches), 32 pages. Paper bound. Illustrated. (Price: 10 c.)
- 1937**
WILSON (P. W.).
 The romance of the calendar. How man has measured time through the ages.
 New York, W. W. Norton & Co. Inc. 351 pages.

In Italian.

- 1936** **691 & 721**
SANTARELLA (L.).
 Il cemento armato. Vol II: Le applicazioni di costruzioni civili ed industriali. Vol. III: Atlante e tabelle. Bologna, Libreria L. Cappelli. 2 volume, 517 e 392 pagine e figure. (Prezzo: 117 Lire.)
- 1937** **385 &**
VEZZANI (F.).
 I trasporti terrestri.
 Firenze, Cya. 1 volume, 314 pagine e tabelle.
- 1936** **621**
ZERIALI (G.).
 Saldatura elettrica.
 Milano, Marucelli. 1 volume, 174 pagine e 177 figure.

II. — PERIODICALS.

In French.

- Annales des Ponts et Chaussées (Paris).**
- 1936** **624 .2**
 Annales des Ponts et Chaussées, octobre, p. 443.
 MANDEL. — Le flambage en milieu résistant élastique. (8 300 mots & fig.)
- 1936** **624 .51**
 Annales des Ponts et Chaussées, novembre, p. 583.
 GRELOT. — Note sur le culottage des câbles de ponts suspendus. (2 000 mots & fig.)

- 1936** **624**
 Annales des Ponts et Chaussées, novembre, p. 599.
 FOULON (E.). — Etude des poutres à losanges: théorie des lignes d'influence des poutres droites treillis à Croix de Saint-André (17 000 mots & fig.)
- Annales des travaux publics de Belgique. (Bruxelles.)**
- 1936** **62. (01 & 02)**
 Annales des Travaux publics de Belgique, décembre, p. 851.
 DUTRON (R.). — Déformations lentes du béton armé sous l'action des charges permanentes (10 500 mots, 13 tableaux & fig.). (A suivre.)

Bulletin de la Société des ingénieurs civils de France. (Paris.)

1936 62. (01 & 669

Bull. de la Société des ing. civ. de France, septembre-octobre, p. 645.

GUILLET (L.), Fils & BASTIEN (P.). — Tendances nouvelles dans l'étude des propriétés mécaniques des métaux et alliages. — Récents progrès dans le domaine du magnésium et des alliages ultra légers. (17 000 mots & fig.)

1936 621 .43 (.437)

Bull. de la Société des ing. civ. de France, septembre-octobre, p. 703.

KORINEK (A.). — Les automotrices Diesel à transmission électrique en Tchécoslovaquie. (3 200 mots & fig.)

1936 621 .392

Bull. de la Société des ing. civ. de France, septembre-octobre, p. 717.

LANGUEPIN (J. E.). — Les progrès de la soudure électrique par résistance. (4 500 mots & fig.)

1937 624

Bull. de la Société des ing. civ. de France, fascicule N° 3, p. 71.

BENEZIT (V.). — Evolution de la technique des ponts métalliques. (2 300 mots.)

Bulletin de l'Association française des amis des Chemins de fer (Paris).

1937 385. (09 (.73)

Bull. de l'Assoc. française des Amis des Chemins de fer, janvier, p. 5.

SHERRINGTON (C. E. R.). — Progrès techniques ferroviaires aux Etats-Unis. (4 700 mots & fig.)

1937 621 .138.1

Bull. de l'Assoc. française des Amis des Chemins de fer, février, p. 25.

MARTIN (C.). — La vie d'un grand dépôt. (6 300 mots & fig.)

Bulletin de l'Union internationale des chemins de fer. (Paris.)

1937 385. (.73)

Bull. de l'Union intern. des Chem. de fer, janvier, p. 1.

SHERRINGTON (C. E. R.). — Les grands réseaux de Chemins de fer des Etats-Unis en 1934 et 1935 (11 000 mots.)

1937 385. (.44)

Bull. de l'Union intern. des Chem. de fer, janvier, p. 15.

Les grands réseaux de Chemins de fer français en 1935. (7 000 mots.)

Bulletin des transports internationaux par chemins de fer. (Berne.)

1937 347 .762

Bull. des transp. intern. par Chem. de fer, février, p. 51.

POLLACZEK (G.). — Le domiciliataire. (1 800 mots.)

1937 313 .385 (.497.1)

Bull. des transp. intern. par Chem. de fer, février, p. 77.

Les Chemins de fer du Royaume yougoslave pendant l'exercice 1935. (500 mots.)

Bulletin technique de la Suisse romande. (Vevey.)

1937 721 .9

Bull. techn. de la Suisse romande, n. 3, 30 janvier, p. 28.

PARIS (A.). — Mise en tension préalable des armatures du béton armé. Son principe, son calcul et ses applications. (Suite et fin). (3 300 mots & fig.)

Chronique des transports. (Paris.)

1937 656 (.65)

Chronique des transports, N° 2, 25 janvier, p. 2.

La coordination du rail et de la route. L'exemple de l'Algérie. (3 500 mots.)

1937 385. (09 (.59)

Chronique des transports, N° 2, 25 janvier, p. 11.

L'achèvement du chemin de fer transindochinois. (2 000 mots.)

1937 385 (.44)

Chronique des transports, N° 3, 10 février, p. 3.

L'évolution des chemins de fer en 1935. (7 000 mots.)

Génie civil. (Paris.)

1937 621 .392 & 625 .143

Génie civil, N° 2842, 30 janvier, p. 106.

L'emploi de la soudure pour la constitution de rails très longs, ainsi que pour la construction des appareils de voie. (3 800 mots.)

1937 621 .114

Génie civil, N° 2842, 6 février, p. 136.

BRILLIE (H.). — Le « Film de graisse consistante » et son application au graissage des roulements. La douille Warlop. (3 400 mots & fig.)

1937 62. (01 & 669

Génie civil, N° 2844, 13 février, p. 156.

REGNAULD (P.). — La sécurité et la légèreté dans la construction mécanique. (2 100 mots & fig.)

1937 698

Génie civil, N° 2844, 13 février, p. 162.

VARLAN (G.). — Les peintures antirouille et les peintures étanches. (1 500 mots.)

1937 62. (01 & 721 .9
Génie civil, N° 2844, 13 février, p. 182.

BOUTRY (P.). — Calcul des sections en **béton armé** soumises à la flexion simple ou composée. (3 000 mots & fig.)

1937 62. (01 & 721 .9
Génie civil, N° 2844, 13 février, p. 187.

LOSSIER (H.). — La limite de fatigue des aciers spéciaux dans les **constructions en béton armé**. (800 mots.)

La Science et la Vie. (Paris.)

1937 625 .258
La Science et la Vie, février, p. 111.

DEVAUX (P.). — Automatismes, télécommande, facteurs de progrès dans l'**exploitation ferroviaire**. (3 800 mots & fig.)

La Technique moderne. (Paris.)

1937 697
La Technique moderne, N° 2, 15 janvier, p. 33.

DUPUY (R.). — Le **conditionnement** de l'air des locaux habités. (7 700 mots & fig.)

1937 621 .43 (.438)
La Technique moderne, N° 2, 15 janvier, p. 54.

La première **automotrice polonaise** à transmission électrique. (6 500 mots & fig.)

1937 621 .392
La Technique moderne, N° 4, 15 février, p. 135.

Quelques applications importantes de la **soudure électrique**. (1 300 mots & fig.)

L'Économie internationale. (Paris.)

1937 656
L'Économie internationale, février, p. 42.

KLINGER (U.). — La **coordination air-fer**. Les points saillants du problème. (1 400 mots & fig.)

Le Container. (Paris.)

1936 656 .225 (.42) & 656 .261 (.42)
Le Container, décembre, p. 4.

CHARLTON (S.). — Progrès accomplis dans les **transports ferroviaires des denrées périssables** en Grande-Bretagne. (3 200 mots.)

1936 656 .225 (.73) & 656 .261 (.73)
Le Container, décembre, p. 14.

Les **containers réfrigérants** et isothermes aux États-Unis d'Amérique. (700 mots.)

1936 656 .225 (.4) & 656 .261 (.4)
Le Container, décembre, p. 16.

Les caractéristiques des **containers réfrigérants** et isothermes européens. (3 800 mots.)

1936 656 .225 (.43) & 656 .261 (.4)
Le Container, décembre, p. 23.

Les **containers réfrigérants** de la Deutsche Reichsbahn. (1 900 mots.)

1936 656 .225 (.439) & 656 .261 (.43)
Le Container, décembre, p. 27.

MERX (P.). — Les **containers réfrigérants** hongrois pour le transport de denrées alimentaires. (1 400 mots.)

1936 656 .225 & 656 .261
Le Container, décembre, p. 30.

HERYNGFET (E.). — Méthodes d'isolation pour **containers spéciaux**. (1 700 mots.)

Les Chemins de fer et les Tramways. (Paris.)

1937 621 .
Les Chemins de fer et les Tramways, janvier, p. 5.

Quelques nouveaux **moteurs Diesel** pour la traction en Allemagne. (2 700 mots & fig.)

1937 621 .135.4 & 625 .2
Les Chemins de fer et les Tramways, janvier, p. 8.

RAOZ (E.). — **Marche en courbe** du matériel des chemins de fer. (3 600 mots & fig.)

1937 625 .1
Les Chemins de fer et les Tramways, janvier, p. 11.

Treuil pour la manœuvre à distance des **barrières basculantes de passage à niveau**. (1 800 mots & fig.)

1937 625 .2
Les Chemins de fer et les Tramways, janvier, p. 13.

Perfectionnements aux **suspensions des bogies**. (1 500 mots & fig.)

1937 625 .1
Les Chemins de fer et les Tramways, janvier, p. 14.

Dispositif pour l'enregistrement des **points bas d'usage voie ferrée**. (1 300 mots & fig.)

1937 60
Les Chemins de fer et les Tramways, janvier, p. 16.

CHARRIN (V.). — Les gaz naturels peuvent-ils, chez nous, servir de **carburants**. (2 700 mots.)

L'Ossature métallique. (Bruxelles.)

1937 621 .392 (.493) & 624 .32 (.493)
L'Ossature métallique, février, p. 69.

DELPÉRDANGE (N.). — Les **ponts** en aval de l'Escaut, à Liège. (900 mots & fig.)

Revue de l'Ecole polytechnique. (Bruxelles.)

1937 691 & 692
Revue de l'Ecole polytechnique, janvier, p. 99.

CAPEL (J.). — Enduits et revêtements dans la **construction en béton**. (11 000 mots & fig.)

Revue générale des chemins de fer. (Paris.)

1937 **621 .131.3 (.44) & 621 .132.3 (.44)**

Revue Générale des Chemins de fer, janvier, p. 3.
PONCET et LEGUILLE. — Améliorations apportées
aux machines de vitesse du réseau de l'Est. (5 400 mots
& fig.)

1937 **656 .211.5 (.44)**

Revue Générale des Chemins de fer, janvier, p. 19.
DANTIN. — Le chauffage central de la gare Saint-
Lazare. (3 600 mots & fig.)

1937 **621 .133.7**

Revue Générale des Chemins de fer, janvier, p. 30.
PETIT (R.). — Considérations sur les désincrustants.
(5 400 mots & fig.)

1937 **385 .11 (.44) & 656 .27 (.44)**

Revue Générale des Chemins de fer, janvier, p. 40.
LESCURE (H.). — La ligne de Chemin de fer de
Paris-Invalides à Versailles. (10 000 mots & fig.)

1937 **385 (.47)**

Revue Générale des Chemins de fer, janvier, p. 77.
ILINSKY (A.). — Nouvelles lignes des chemins de
fer russes. (2 200 mots & fig.)

1937 **621 .131.3 (.44)**

Revue Générale des Chemins de fer, février, p. 91.
PLACE (P.). — Un exemple d'essai de locomotives
au banc de Vitry. (2 900 mots, tableaux & fig.)

1937 **621 .118 (.44)**

Revue Générale des Chemins de fer, février, p. 106.
CHAN. — Note sur une explosion de chaudière de
locomotive. (3 000 mots & fig.)

1937 **625 .232 (.44)**

Revue Générale des Chemins de fer, février, p. 115.
PLA. — Nouvelle voiture métallique de grandes li-
gnes, étudiée par l'Office Central d'Etudes de Matériel
de Chemins de fer. (6 300 mots & fig.)

1937 **625 .113**

Revue Générale des Chemins de fer, février, p. 135.
VINOT. — La constitution des courbes pour les vi-
tesses élevées (études de la Reichsbahn). (2 200 mots
& fig.)

Revue universelle des Mines. (Liège.)

1937 **621 .11**

Revue Universelle des Mines, février, p. 46.
SMAL (F.). — Les caractères physiologiques du gé-
nérateur à vapeur et expression pratique de son rende-
ment. (9 000 mots & fig.)

1937 **621 .43 & 662**

Revue Universelle des Mines, février, p. 67.
JACOVLEFF (D. V.). — Combustibles pour moteurs
Diesel rapides. (4 800 mots & fig.)

In German.

Archiv für Eisenbahnwesen. (Berlin.)

1936 **656 .23**

Archiv für Eisenbahnwesen, Nr. 2, S. 245.
WIEDENFELD. — Monopoltendenz und Frachten-
gestaltung im Eisenbahnwesen. (52 Seiten.)

1936 **385 .1 (.44)**

Archiv für Eisenbahnwesen, Nr. 2, S. 297.
Die Entwicklung der französischen Eisenbahnen in
den letzten 15 Jahren (1920 bis 1935) und die Mass-
nahmen zur Hebung ihrer finanziellen Lage. (48 Seiten.)

1936 **656 (.73)**

Archiv für Eisenbahnwesen, Nr. 2, S. 371.
BERCHTOLD. — Die Massnahmen zur Sanierung
des Verkehrs in den Vereinigten Staaten von Amerika.
(20 Seiten). (Fortsetzung folgt.)

Die Reichsbahn. (Berlin.)

1935 **625 .21 (.43)**

Reichsbahn, Heft 41, S. 1059.
LUTTEROTH. — Vermessen und Verwiegen von
Personenwagenkästen und Prüfen der Drehgestelle. Un-
tersuchungen im Rahmen der Arbeiten der Arbeitsge-
meinschaft « für Anstellung einer Dienstvorschrift für
die Erhaltung der Wagen in den Reichsbahn-Ausbesser-
ungswerken ». (9 Seiten & Abb.)

1935 **656 (.43)**

Reichsbahn, Heft 44, S. 1126.
BALLOF. — Die Betrieblichen und baulichen Voraus-
setzungen für die Leistungssteigerung der Reichsbahn.
(4 1/2 Seiten.)

1935 **621 .132.1 (.43)**

Reichsbahn, Heft 52, S. 1296.
FUCHS. — Die neuere Entwicklung des Lokomotiv-
baues bei der Deutschen Reichsbahn. (21 Seiten, Diagr.
& Abb.)

1937 **656 .211.5 (.43)**

Die Reichsbahn, Heft 4, 27. Januar, S. 86.
KRECK. — Der Umbau des Empfangsgebäudes in
Mainz Hauptbahnhof. (1 200 Wörter & Abb.)

1937 **621 .138.5 (.43) & 625 .26 (.43)**

Die Reichsbahn, Heft 5, 3. Februar, S. 109.
KÜHNE (P.). — Erhaltungsarbeit und Erhaltungswirtschaft. (6 000 Wörter & Abb.)

1937 **656 .211 (.43)**

Die Reichsbahn, Heft 6, 10. Februar, S. 127.
GROTEPASS. — Moderne Betriebsentwicklung auf
dem Bahnhof Dortmund Hauptbahnhof. (4 200 Wörter
& Abb.)

1936 **625 .4 (.43)**

Reichsbahn, Heft 6, S. 131.
GRABSKI. — Vom Bau der Berliner Nordsüd-S-Bahn.
Zweiter Bildbericht. (8 Seiten & Abb.)

1937

385 .4 (.43)

Die Reichsbahn, Heft 7, 17. Februar, S. 141.

Der **Neuaufbau der Reichsbahn.** (2 700 Wörter & Abb.)

1937

656 .25 (.43)

Die Reichsbahn, Heft 7, 17. Februar, S. 144.

FREYSS. — Durch welche Massnahmen erreicht die Reichsbahn ihren hohen Grad der **Betriebssicherheit**? (9 000 Wörter.)

1937

624 (.43) & 656 .1 (.43)

Die Reichsbahn, Heft 8, 24. Februar, S. 165.

SCHAPER (G.). — Der **Brückenbau** der Reichsautobahnen im Jahre 1936. (5 800 Wörter & Abb.)

1936

656 .213 (.43)

Reichsbahn, Heft 12, S. 245.

PLATZ. — Der **Eisenbahnhof** Bremen. (5 Seiten & 1 Karte.)

1936

385 .1 (.43)

Reichsbahn, Heft 14, S. 296.

PRANG. — Grundsätzliches zur **Finanzwirtschaft** der Deutschen Reichsbahn. (7 Seiten.)

Elektrische Bahnen. (Berlin.)

1937

625 .62

Elektrische Bahnen, Dezember, S. 309.

VOIGTLÄNDER (H.). — Grenzen der **Reisegeschwindigkeit bei Strassenbahnen.** (7 200 Wörter & Abb.)

1937

621 .33

Elektrische Bahnen, Dezember, S. 323.

KÖVESSIJUN (F.). — Ein **Einphasen-Dreiphasen-Bahntriebssystem** mit Stromrichter. (8 600 Wörter & Abb.)

Glaser's Annalen. (Berlin.)

1937

385. (01 (.6)

Glaser's Annalen, Heft 2, 15. Januar, S. 13.

METZELTIN. — Die **Transsaharabahn.** (3 500 Wörter & Abb.)

Organ für die Fortschritte des Eisenbahnwesens. (Berlin.)

1937

625 .144.2

Organ für die Fortschritte des Eisenbahnwesens, Heft 3, 1 Februar, S. 39.

VOGEL (R.). — Grenzen der **Überhöhung** in Gleisbogen. (3 300 Wörter, 8 Tafeln & Abb.)

1937

625 .14 (01

Organ für die Fortschritte des Eisenbahnwesens, Heft 3, 1 Februar, S. 47.

HOFER (B.). — Die kraftschlüssige **Verspannung** der Gleisteile. (3 500 Wörter & Abb.)

1937

625 .14

Organ für die Fortschritte des Eisenbahnwesens, Heft 3, 1 Februar, S. 52.

BERCHTENBREITER. — Zum Stande der **Schienebaustofffragen.** (5 200 Wörter.)

1937

621 .43 & 625 .1

Organ für die Fortschritte des Eisenbahnwesens, Heft 4, 15. Februar, S. 59.

GROSPIETSCHE (K.). — Heizungen für **Verbrennungstriebwagen** und ihre Beiwagen. (4 200 Wörter & Abb.)

1937

621 .13

Organ für die Fortschritte des Eisenbahnwesens, Heft 4, 15. Februar, S. 64.

TRAUTNER (H.). — Die **Ausnutzung des Abdampfvorwärmers** im Lokomotivbetrieb. (3 300 Wörter & Abb.)

1937

621 .13

Organ für die Fortschritte des Eisenbahnwesens, Heft 4, 15. Februar, S. 69.

METZELTIN. — **Lokomotive mit Abgasvorwärmer** Bauart Franco. (1 200 Wörter & Abb.)

1937

656 .2

Organ für die Fortschritte des Eisenbahnwesens, Heft 4, 15. Februar, S. 71.

LEHNER (W.). — **Indirekte Stellwerkbeleuchtung** (4 000 Wörter & Abb.)

1937

621 .134.1 (.4

Organ für die Fortschritte des Eisenbahnwesens, Heft 4, 15. Februar, S. 75.

Kropfachs-Versuche der Paris-Lyon-Mittelmeerbahn (800 Wörter & Abb.)

Verkehrstechnische Woche. (Berlin.)

1935

625 .24 (.4

Verkehrstechnische Woche, Nr. 40, S. 517.

SCHINKE. — Der heutige Stand der **Laufverbesserung bei Eisenbahngüterwagen.** (8 Seiten & Abb.)

1935

385 .517

Verkehrstechnische Woche, Nr. 43, S. 554.

BRAMESFELD & BRINKMANN. — Einfluss der **Blendung des Auges auf das Erkennen farbiger Eisenbahnsignale.** 4 1/2 Seiten & Diagr.)

1935

625 .2

Verkehrstechnische Woche, Nr. 45, S. 577.

PONTANI. — **Behandlung der Personenwagen nach der Fahrt.** (4 Seiten & Diagr.)

1935

656 .225 & 656 .1

Verkehrstechnische Woche, Nr. 47, S. 609.

LILLIENDAHL. — **Roll- oder Hubbehälter?** (4 Seiten & Abb.)

1936

621 .138.5 (.43) & 625 .26 (.4

Verkehrstechnische Woche, Nr. 2, S. 13.

KUEHNE. — Die **Erhaltungswirtschaft** der Deutschen Reichsbahn. (9 Seiten & Diagr.)

- 1936** **656 (.43)**
Verkehrstechnische Woche, Nr. 3, S. 30.
GERTZEN. — Die **deutschen Verkehrsmittel** in und seit der letzten Wirtschaftskrise im Spiegel der Statistik. (2 Seiten.)
-
- 1936** **621 .33 (.43)**
Verkehrstechnische Woche, Nr. 4, S. 37.
TETZLAFF. — Ein Vierteljahrhundert deutschen **elektrischen Fernbahnbetriebes**. (10 Seiten & Abb.)
-
- 1936** **621 .132.6 (.43)**
Verkehrstechnische Woche, Nr. 6, S. 61.
FLEMMING. — Neue **Tenderlokomotive** der Reichsbahn für Steigungsstrecken mit starken Krümmungen. (5 Seiten & Abb.)
-
- 1936** **385**
Verkehrstechnische Woche, Nr. 7, S. 76, Nr. 10, S. 109.
HAUSTEIN. — **Moderne Probleme des Eisenbahn-Verwaltungswesens** im Lichte der Vergangenheit. (10 1/2 Seiten.)
-
- 1936** **625 .19**
Verkehrstechnische Woche, Nr. 11, S. 121; Nr. 12, S. 137; Nr. 13, S. 149.
STICHT. — **Einwirkungen der durch Bergbau hervorgerufenen Bodenverschiebungen auf das Gleis**. (19 Seiten, Diagr. & Abb.)
-
- 1936** **656 (.43)**
Verkehrstechnische Woche, Nr. 12, S. 133.
CAPELLE. — **Strasse und Schiene im Güterverkehr**. (4 Seiten.)
-
- 1936** **656 .212.5**
Verkehrstechnische Woche, Nr. 14/15, S. 158.
Jahresbericht der Studiengesellschaft für **Rangier-technik**. (Geschäftsjahr 1935). (7 Seiten & 1 Tafel.)
-
- 1936** **625 .258 (.43) & 656 .212.5 (.43)**
Verkehrstechnische Woche, Nr. 14/15, S. 165.
WAGNER. — **Zehn Jahre einheitlich mechanisierte Ablaufanlage**. (5 Seiten & Abb.)
-
- 1936** **656 .212.5**
Verkehrstechnische Woche, Nr. 14/15, S. 170.
WENZEL & WICKE. — **Stufenweiser Ausbau von Ablaufanlagen**. (5 Seiten & Tafeln.)
-
- 1936** **656 .212.5**
Verkehrstechnische Woche, Nr. 14/15, S. 183.
GOTTSCALK. — **Laufwiderstände der Güterwagen**. (11 Seiten & Diagr.)
-
- 1936** **656 .212.5**
Verkehrstechnische Woche, Nr. 14/15, S. 194.
DIEHL. — **Neuzeitliche Entwicklung und betriebliche Auswirkung der Verständigungsmittel des Rangierdienstes**. (6 Seiten.)
-
- 1936** **656 .212.5**
Verkehrstechnische Woche, Nr. 14/15, S. 210.
TECKLENBURG. — **Der Beidrückdienst in Rangierbahnhöfen**. (1 Seite.)

- 1936** **656 .23 (.43)**
Verkehrstechnische Woche, Nr. 16/17, S. 213.
KOENIGS. — **Tarifpolitik-Verkehrspolitik**. (4 Seiten.)
-
- 1936** **656 (.43)**
Verkehrstechnische Woche, Nr. 16/17, S. 223.
LEIBBRAND. — **Reichsbahnaufgaben und Schienentechnik**. (4 Seiten.)
-
- 1936** **625 .14**
Verkehrstechnische Woche, Nr. 19, S. 249.
DELSCHL. — **Der rahmensteife Spannkeil-Oberbau, ein Weg zum « wartungsfreien » Gleis**. (6 1/2 Seiten.)
-
- 1936** **621 .43**
Verkehrstechnische Woche, Nr. 22, S. 285.
EBERT. — **Die Erhaltung der Fahrzeuge mit Verbrennungsmotoren**. (6 1/2 Seiten & Diagr.)
-
- 1936** **625 .245 (.43)**
Verkehrstechnische Woche, Nr. 23, S. 297.
BODE. — **Die Kübelwagen der Deutschen Reichsbahn**. (9 Seiten & Abb.)
-
- 1936** **656 (.43)**
Verkehrstechnische Woche, Nr. 26, S. 333.
EBHARDT. — **Organischer Aufbau des Verkehrs**. (Stand: Ende Mai 1936). (6 Seiten & Graph.) Fortsetzung folgt.)
-
- Zeitschrift des Vereines Deutscher Ingenieure.**
(Berlin.)
-
- 1937** **62. (01 & 669**
Zeitsch. des Ver. deutsch. Ing., Nr. 5, 30. Januar, S. 119.
STORCH (M.). — **Fertigguss**. (3 900 Wörter, 6 Tafeln & Abb.)
-
- 1937** **669**
Zeitsch. des Ver. deutsch. Ing., Nr. 5, 30. Januar, S. 126.
Die hexagonale Struktur des **Magnesiums**. (700 Wörter & Abb.)
-
- 1937** **698**
Zeitsch. des Ver. deutsch. Ing., Nr. 5, 30. Januar, S. 127.
KRAUSE (H.). — **Chemische Färbung der Metalle**. (5 400 Wörter.)
-
- 1937** **691 & 721 .9**
Zeitsch. des Ver. deutsch. Ing., Nr. 6, Februar, S. 149.
CASPER (H.). — **Stand der Betonbauweise**. Entwurf-Ausführung. (4 000 Wörter & Abb.)
-
- 1937** **621 .9 (.43)**
Zeitsch. des Ver. deutsch. Ing., Nr. 8, 20. Februar, S. 203.
FEHSE (A.). — **Werkzeugmaschinen**. Vorschau auf die Technische Messe Leipzig 1937. (6 300 Wörter & Abb.)

Zeitschrift für das gesamte Eisenbahn-Sicherungswesen. (Berlin.)

1937 **656 .256**
Zeitsch. für das ges. Eisenb.-Sicherungsw., Nr. 2, 1. Februar, S. 17.

NITSCHKE. — Die Vereinheitlichung der Wechselstrom-Blockanlagen. (3 900 Wörter & Abb.)

1937 **656 .254 (.43)**
Zeitsch. für das ges. Eisenb.-Sicherungsw., Nr. 3, 20. Februar, S. 29.

HOFMANN (F.). — Die optische Zugbeeinflussung auf der Strecke Berlin-Stettin. (4 800 Wörter & Abb.)

Zeitung des Vereins mitteleuropäischer Eisenbahnverwaltungen. (Berlin.)

1937 **385 (.4)**
Zeitung des Ver. mitteleurop. Eisenbahnverw., Nr. 3, 21. Januar, S. 41; Nr. 4, 28. Januar, S. 65; Nr. 5, 4 Februar, S. 85.

Rückblick auf das Jahr 1936. (44 000 Wörter.)

1937 **656 .235.1**
Zeitung des Ver. mitteleurop. Eisenbahnverw., Nr. 8, 25. Februar, S. 147.

LOHSE. — Zur Frage der Lieferfrist im kombinierten Schiene-Kraftwagenverkehr. (2 500 Wörter.)

In English.

Annals, American Academy of Political and Social Science. Philadelphia.)

1937 **3. (06 (.73) & 351. (.73)**
Annals, Amer. Acad. of Political and Social Science, January.

Improved personal in Government service. A series of 32 articles dealing with: spoils and democracy, the development of a professional public service; new techniques of public personnel administration; the reform movement, etc.

Bulletin, American Railway Engineering Association. (Chicago, Ill.)

1936 **625 .143 (.73)**
Bulletin, Americ. Ry. Engineering Assoc., November, p. 215.

Report of committee on **RAIL**. Revision of Manual, Mill practice, Rail failure statistics for 1935. Transverse fissure statistics. The A. A. R. detector car. Cause and prevention of rail battering. Rail lengths in excess of 39 feet. Continuous welding of rail. Service tests of various types of joint bars. Effect of contour of the head of rail sections on the wear. 112-lb. R. E. rail section (revised). Outline of complete field of work of the Committee, etc. (10 000 words & fig.)

1936

625 .162 (.7)
Bulletin, Americ. Ry. Engineering Assoc., November, p. 255.

Report of committee on **highways**. Revision of manual. 90 degree sheet steel crossing sign assembly suspension over highway and details. Designs and specifications for highway crossings at grade over railway tracks, both steam and electric. « Gates-Not-Walking » and « Watchmen-Not-On-Duty » signs. Barrier type of grade crossing protection, including automatic gates. Outline of complete field of work of the committee. (3 500 words & fig.)

1936

721 .9 (0)
Bulletin, Americ. Ry. Engineering Assoc., November, p. 273.

Report of committee on **buildings**. Revision of manual; freight houses; roofings. Specifications for railway buildings. Different types of paint and the economical selection-exposure record. Design of small cold storage plants for railway use. Stockpens. Outline of complete field of work of the committee. (15 000 words & fig.)

1936

721 .9 (0)
Bulletin, Americ. Ry. Engineering Assoc., November, p. 301.

Report of committee on **iron and steel structures**. Application of and specifications for fusion welding and gas cutting to steel structures. Outline of complete field of work of the committee. (4 500 words.)

1936

621 .142.2 (.73) & 691 (.7)
Bulletin, Americ. Ry. Engineering Assoc., November, p. 309.

Report of committee on **wood preservation**. Service test records for treated ties. Piling used for marine construction. Destruction by termites and possible ways of prevention. Outline of complete field of work of the committee. (11 000 words, tables & fig.)

1936

385 .5 (.7)
Bulletin, Americ. Ry. Engineering Assoc., November, p. 355.

Report of committee on **economics of railway labor**. Analysis of operations of railways that have marked progress in reduction of labor required in maintenance of way work. Organization of forces and methods of performing maintenance of way work. Economies in labor to be effected through increased capital expenditures. Economies in track labor to be effected in the maintenance of joints by welding and the use of reformed bars. Effect of higher speeds on the labor cost of track maintenance. Outline of complete field of work of the committee. (9 000 words & fig.)

Electrical Industries (London).

1936

621 .335 & 621 .3
Electrical Industries, N° 1854, October 21, p. 1543.

Diesel-electric traction. Recent progress with locomotives and streamlined trains. (1 500 words & fig.)

1936 **621 .331 (.494)**
Electrical Industries, N° 1854, October 21, p. 1554.
A travelling rectifier. (900 words & fig.)

1936 **621 .331**
Electrical Industries, N° 1857, p. 1643.
PARKER SMITH (S.). — Traction type mercury arc rectifiers. (3 200 words & fig.)

1936 **621 .335**
Electrical Industries, N° 1857, p. 1654.
BROOKS (R. W.). — Electric locomotives annual mileages exceed those possible with steam (2 900 words, tables & fig.)

1936 **621 .331**
Electrical Industries, N° 1857, p. 1686.
CARR (T. H.). — Power station switch houses; basic principles apply to the modern plant. (2 600 words, tables & fig.)

1936 **621 .335**
Electrical Industries, N° 1857, p. 1693.
STRAUSS (Fr.). — The drive of electric main-line locomotives. (2 500 words & fig.)

1936 **621 .338 (.42)**
Electrical Industries, N° 1859, November 25, p. 1723.
Modern trains. New rolling stock for the London Passenger Transport Board. (3 000 words & fig.)

1937 **656 .259**
Electrical Industries, N° 1870, February 10, p. 169.
A safety device for trains and railcars. (600 words & fig.)

1937 **621 .392 (.494)**
Electrical Industries, N° 1870, February 10, p. 175.
New welding processes in Switzerland. (1 100 words & fig.)

Engineer. (London.)

1937 **691**
Engineer, N° 4229, January 29, p. 129.
WIGMORE (V. S.). — Winter concreting (2 000 words.)

1937 **621 .13 (093)**
Engineer, N° 4229, January 29, p. 130.
DENDY MARSHALL (C. F.). — Links in the history of the locomotive. (1 400 words & fig.)

1937 **669**
Engineer, N° 4229, January 29, p. 138.
New ferrous alloys and treatment. (1 500 words.)

1937 **621 .392**
Engineer, N° 4229, January 29, p. 141.
D. C. welding sets. (700 words.)

1937 **621 .133**
Engineer, N° 4230, February 5, p. 155.

LEWIS-DALE (P.). — Efficiency of the locomotive furnace. (From a paper entitled « some measurements by gas analysis of the efficiency of the locomotive furnace », read at the Institute of Fuel on November 25th, 1936). (5 000 words & fig.)

1937 **621 .31**
Engineer, N° 4230, February 5, p. 165.
A wattless current output limiter. (600 words.)

1937 **62. (064 (.42)**
Engineer N° 4231, February 12, p. 180.
The British industries fair at Birmingham. (4 000 words & fig.). (*To be continued.*)

1937 **656 .212.6 (.52)**
Engineer, N° 4231, February 12, p. 185.
TAJI (J.). — Coal shipping equipment at Muroran harbour. (2 000 words & fig.)

1937 **621 .43 (.42)**
Engineer, N° 4232, February 19, p. 215.
Railcar for trailer haulage. (1 500 words & fig.)

Engineering. (London.)

1937 **621 .43 (.82)**
Engineering, N° 3707, January 29, p. 130.
255-H.P. oil-engine railcars with mechanical transmission. (1 000 words.)

1937 **621. (06 (∞)**
Engineering, N° 3707, January 29, p. 132.
The third world power conference. (3 500 words). (*To be continued.*)

1937 **621 .43**
Engineering, N° 3707, January 29, p. 136.
RICARDO (H. R.). — High-speed diesel engines. (5 000 words & fig.)

1937 **62. (01 & 691**
Engineering, N° 3708, February 5, p. 161.
EVANS (R. H.) and WOOD (R. H.). — Transverse elasticity of building materials. (5 000 words & fig.)

1937 **621 .43**
Engineering, N° 3708, February 5, p. 164.
BAKER (H. W.). — Piston temperatures in a sleeve-valve oil engine. (1 500 words & fig.)

1937 **62. (064 (.42)**
Engineering, N° 3709, February 12, p. 167.
The British industries fair at Birmingham-I. (19 000 words). (*To be continued.*)

1937 **656 .25 (0**
Engineering, N° 3710, February 19, p. 218.
Railway signalling terms. (500 words.)

1937 **621 .334**
Engineering, N° 3710, February 19, p. 219.
30-ton platform truck. (500 words.)

Engineering News-Record. (New York.)

1937 **624 .9 (.44)**
Engineering News-Record, N° 2, January 14, p. 49.
All-steel hangars in France have suspended plate roofs. (350 words & fig.)

1937 **621 .392 (.71) & 624 (.71)**
Engineering News-Record, N° 2, January 14, p. 52.
ARMSTRONG (D. B.). — Welded design for six-span continuous girder bridge. (2 800 words & fig.)

1937 **624 .51 (.728)**
Engineering News-Record, N° 3, January 21, p. 87.
Mc CULLOUGH (C. B.) and ARCHIBALD (R.). — Bridging the Rio Choluteca with a two-span suspension structure. (1 800 words & fig.)

1937 **625 .111 (.73) & 625 .162 (.73)**
Engineering News-Record, N° 4, February 4, p. 200.
BRENNAN (J. G.). — Level crossing elimination in the U. S. A. (4 000 words & tables.)

Journal, Institute of Transport. (London.)

1937 **347 .763 (.42) & 656. (.42)**
Journal, Institute of Transport, February, p. 152.
GAUNT (W. H.). — Transport from an operating trader's viewpoint. (15 000 words.)

1937 **656 .213**
Journal, Institute of Transport, February, p. 167.
CUNNINGHAM (B.). — Maritime passenger stations. (9 000 words & tables.)

Journal, Institution of Civil Engineers. (London.)

1937 **62. (01 & 624**
Journal, Institution of Civil Engineers, February, p. 91.
NICHOLS (H. J.). — Pre-stressing bridge girders. (30 000 words & fig.)

1937 **62. (01, 624 .9 & 721 .9**
Journal, Institution of Civil Engineers, February, p. 196.
RICHARDS (J. C.). — Stress-determination for a three-dimensional rigid-jointed framework by the method of systematic relaxation of constraints. (8 000 words & tables.)

Modern Transport. (London.)

1937 **621 .43 (.82)**
Modern Transport, N° 933, January 30, p. 3.
Diesel railcars from the Argentine. Semi-streamlined units with buffets. (1 200 words & fig.)

1937 **388 (.4**
Modern Transport, N° 933, January 30, p. 5.
Preparing tramway routes for trolleybuses. (3 000 words, maps & fig.)

1937 **656 .2**
Modern Transport, N° 933, January 30, p. 7.
Port management and facilities. (2 800 words.)

1937 **656 .212 (.4**
Modern Transport, N° 934, February 6, p. 3.
L. M. S. freight terminal reconstruction schemes. (9 000 words & fig.)

1937 **621 .132.8 (.43 + .7**
Modern Transport, N° 934, February 6, p. 5.
Steam railcars in the U. S. A. and Germany. (1 200 words & fig.)

1937 **621 .13 (.73), 625 .1 (.73) & 625 .2 (.7**
Modern Transport, N° 934, February 6, p. 7.
DOWNS (L. A.). — New methods in railway engineering. (2 000 words.)

1937 **621 .43 (.4**
Modern Transport, N° 935, February 13, p. 4.
Oil-engined railcars on G. W. R. (1 500 words & fig.)

1937 **62. (064 (.4**
Modern Transport, N° 935, February 13, p. 6.
British industries fair. (4 600 words.)

1937 **656 .211.5 (.4**
Modern Transport, N° 935, February 13, p. 8.
Ticket-issuing machines. (900 words & fig.)

1937 **656**
Modern Transport, N° 935, February 13, p. 10.
Short-distance road transport. New ideas in vehicle design. (2 800 words & fig.)

1937 **656. (.4**
Modern Transport, N° 936, February 20, p. 3.
MANGE (Sir H. Osborne). — Transport in Germany. Dividing traffic between rail and road. (2 200 words.)

1937 **621 .132.8 (.49**
Modern Transport, N° 936, February 20, p. 5.
Turbine locomotives in freight service. A Swedish repeat order. (1 500 words & fig.)

1937 **656 .253 (.4**
Modern Transport, N° 936, February 20, p. 6.
BOUND (A. F.). — Resignalling to ensure safe running. Distant signals on the L. M. S. (1 800 words & fig.)

1937 **621 .3**
Modern Transport, N° 936, February 20, p. 9.
FAIRBURN (C. E.). — Reasons for main-line railway electrification. (3 500 words.)

Mechanical Engineering. (New York.)

- 1937** **621 .165 (.73)**
 Mechanical Engineering, February, p. 71.
 CHRISTIE (A. G.). — The steam turbine in the United States. Early Allis-Chalmers steam turbines. (9 800 words, tables & fig.)
- 1937** **536 & 621 .1 (0)**
 Mechanical Engineering, February, p. 93.
 Mc DONALD (E. L.) and WINTERS (R.). — Heat balance versus weighed boiler tests. (4 000 words & fig.)
- 1937** **536 & 621 .116 (08)**
 Mechanical Engineering, February, p. 97.
 HECK (R. C. H.). — The Keenan and Keyes steam tables. (1 600 words & fig.)

Proceedings, American Society of Civil Engineers: (New York.)

- 1937** **62. (01 & 624)**
 Proc., Amer. Soc. Civil Eng., January, p. 15.
 GOTTSCHALK (O.). — Structural analysis based upon principles pertaining to unloaded models. (7 000 words & fig.)

Railway Age. (New York.)

- 1937** **625 .232 (.73)**
 Railway Age, N° 2, January 9, p. 108.
 Pullman lightweight sleeper. (1 400 words & fig.)
- 1937** **385 .3 (08 (.73))**
 Railway Age, N° 2, January 9, p. 113.
 Interstate Commerce Commission issues report for 1936. (3 800 words.)
- 1937** **625 .13 (.73)**
 Railway Age, N° 2, January 9, p. 116.
 Care and precision feature rebuilding of Old Big Bend Tunnel floor. (2 500 words.)
- 1937** **347 .763 (.73) & 656 .1 (.73)**
 Railway Age, N° 2, January 9, p. 119.
 Interstate Commerce Commission motor carrier safety rules. (3 000 words.)
- 1937** **347 .763 (.73) & 656 .1 (.73)**
 Railway Age, N° 2, January 9, p. 122.
 FAIRWEATHER (S. W.). — Is truck regulation a failure? (5 000 words.)
- 1937** **656 .211 (.73)**
 Railway Age, N° 3, January 16, p. 142.
 Los Angeles soon to have New Union Station. (2 400 words & fig.)
- 1937** **625 .234**
 Railway Age, N° 3, January 16, p. 146.
 Air conditioning of railroad passenger cars. (5 000 words & tables.)

- 1937** **621 .131.2 & 621 .135 (01)**
 Railway Age, N° 3, January 16, p. 155.
 BLUNT (J. G.). — Proper locomotive design will improve riding qualities. (1 400 words & fig.)
- 1937** **656 .26 (.73)**
 Railway Age, N° 4, January 23, p. 178.
 Union Pacific creates elaborate winter sports center. (3 500 words & fig.)
- 1937** **614 .8 (06 (.73))**
 Railway Age, N° 4, January 23, p. 186.
 Annual report of Bureau of Safety. (2 200 words.)
- 1937** **621 .13 (0 (.73)) & 656 .284 (.73)**
 Railway Age, N° 4, January 23, p. 187.
 Decrease in number of casualties from locomotive accidents. (2 200 words & fig.)
- 1937** **656. (.73)**
 Railway Age, N° 4, January 23, p. 191.
 Building a rail-highway co-ordination system. (1 900 words & fig.)
- 1937** **656 .1 (.73)**
 Railway Age, N° 4, January 23, p. 195.
 Giving West Virginia bus service. Baltimore & Ohio subsidiary provides safe, convenient service in mountain territory. (1 300 words & fig.)
- 1937** **385 .3 (.73) & 347 .764 (.73)**
 Railway Age, N° 4, January 23, p. 197.
 Motor Carrier Act Administration. (2 400 words.)
- 1937** **656 .284 (.73)**
 Railway Age, N° 5, January 30, p. 214.
 Ohio river's worst flood cuts railroads in two. (2 200 words & fig.)
- 1937** **656 .24 (.73)**
 Railway Age, N° 5, January 30, p. 217.
 RICHARDS (C. A.). — See yourself as your passenger sees you. (A passenger asks many questions about improvements in passenger service at low cost). (7 000 words.)
- 1937** **625 .14**
 Railway Age, N° 5, January 30, p. 223.
 REECE (A. N.). — How strong should track be. Some suggestions for the practical application of the results of research in the solution of current problems. (4 200 words.)
- 1937** **625 .214 (.73)**
 Railway Age, N° 5, January 30, p. 228.
 Disc-Ilo journal bearing for high-speed service. (1 200 words.)
- 1937** **621 .133.8 (.73)**
 Railway Age, N° 5, January 30, p. 232.
 The Hancock Turbo-Injector. (1 300 words & fig.)

Railway Engineering and Maintenance. (Chicago.)

1937 **625 .173 (.73)**
 Railway Engineering and Maintenance, January, p. 22.
Special system gangs apply ties on Union Pacific.
 (3 800 words & fig.)

1937 **621 .13 (.73), 625 .1 (.73) & 625 .2 (.73)**
 Railway Engineering and Maintenance, January, p. 25.

DOWNS (L. A.). — What we have done. Address made before the members of the investment Bankers Association at Augusta, Ga., reviewing the progress which the railways have made in various departments in perfecting and improving their practices. (3 000 words & fig.)

1937 **625 .113 (.73) & 625 .143.3 (.73)**
 Railway Engineering and Maintenance, January, p. 27.

RODMAN (T. E.). — Comparing the cost and economies of curve lubrication. (2 400 words & fig.)

1937 **721 .5**
 Railway Engineering and Maintenance, January, p. 28.

A unique skylight problem (Pennsylvania removes approximately 60 000 sq. ft. of glass in work on roof of station in New York. New features of design are incorporated.) (6 200 words & fig.)

1937 **625 .174 (.73)**
 Railway Engineering and Maintenance, February, p. 90.

Keeping a line open in 40 feet of snow. (6 000 words & fig.)

1937 **656 .284 (.73)**
 Railway Engineering and Maintenance, February, p. 95.

Worst Ohio river flood hits railroads. (2 500 words & fig.)

1937 **625 .143.2 (.73) & 625 .143.3 (.73)**
 Railway Engineering and Maintenance, February, p. 97.

Santa Fe end hardens new rails as standard practice. (4 000 words & fig.)

1937 **100**
 Railway Engineering and Maintenance, February, p. 100.

Timely repairs save concrete on the Burlington. (3 700 words & fig.)

1937 **698**
 Railway Engineering and Maintenance, February, p. 104.

BROWNE (F. L.). — Painting problems. What are they today. (4 000 words & fig.)

1937 **624 .31 (.73)**
 Railway Engineering and Maintenance, February, p. 108.

GREGORY (W. B.). — The Lake Pontchartrain trestle. (4 200 words & fig.)

Railway Gazette. (London.)

1937 **621 .132.1 (.42)**
 Railway Gazette, N° 5, January 29, p. 192.

British locomotive types. — I. Great Western Railway. (6 figures.)

1937 **625**
 Railway Gazette, N° 5, January 29, p. 194.

Facing points with special reference to their lock and other safety devices. (1 100 words.)

1937 **621 .39 (.42)**
 Railway Gazette, N° 5, January 29, p. 195.

Metaelectric furnace for normalising welded joint pipes. (500 words & fig.)

1937 **656 .25 (.42)**
 Railway Gazette, N° 5, January 29, p. 196.

Route signalling for London Transport. — I. (1 000 words & fig.). (*To be continued.*)

1937 **625 .144.4 (.42) & 625 .172 (.42)**
 Railway Gazette, N° 5, January 29, p. 198.

Trowel packing of permanent way. (1 300 words & fig.)

1937 **621 .132.6 (.42)**
 Railway Gazette, N° 5, January 29, p. 200.

New tank locomotives for service in Germany. (1 000 words & fig.)

1937 **621 .132.1 (.42)**
 Railway Gazette, N° 6, February 5, p. 232.

British locomotive types. — II. Great Western Railway. (6 figures.)

1937 **656 .253 (.42)**
 Railway Gazette, N° 6, February 5, p. 235.

Signalling in the Belsize (passenger) tunnel L. M. S. (500 words & fig.)

1937 **656 .259 (.42)**
 Railway Gazette, N° 6, February 5, p. 235.

Improved German facing point locking. (250 words & fig.)

1937 **621 .132.3 (.42)**
 Railway Gazette, N° 6, February 5, p. 236.

New 4-4-0 type locomotives, Great Southern Railway Ireland. (350 words.)

1937 **62. (01 (.42) & 625 .212 (.42)**
 Railway Gazette, N° 6, February 5, p. 236.

Destruction tests on cast steel railway wheel centres. (200 words & fig.)

1937 **625 .232 (.62)**
 Railway Gazette, N° 6, February 5, p. 238.

Official saloons for the Gold Coast Railway. (900 words & fig.)

1937 **656 .212 (.42)**
 Railway Gazette, N° 6, February 5, p. 246.

Freight terminal improvements, L. M. S. R. (900 words & fig.)

1937 **625 .143.2 (.73)**
 Railway Gazette, N° 7, February 12, p. 275.

Recent developments in American rail manufacturing. (2 000 words.)

1937 **625 .26 (.42) & 656 .1 (.42)**
 Railway Gazette, N° 7, February 12, p. 280.
Organisation of a Railway company's road motor
engineer's department-III (2 000 words & fig.)

1937 **621 .133.1 (.485)**
 Electric Ry. Traction, p. 258, supplt. to the Ry. Gazette, February 5.
OFVERHOLM (L.). — The substations of the Swedish State Railways. (3 000 words & fig.). (*To be continued.*)

Railway Magazine. (London.)

1937 **656 .21 (093 (.42)**
 Railway Magazine, February, p. 102.
REED (B.) and LEE (C. E.). — London Bridge station. — II. (5 500 words & fig.)

1937 **624. (.44)**
 Railway Magazine, February, p. 113.
Some notable French railway viaducts. (1 400 words & fig.)

Railway Mechanical Engineer. (Philadelphia.)

1937 **621 .132.5 (.73)**
 Railway Mechanical Engineer, January, p. 1.
Union Pacific high-speed freight locomotive. (2 000 words, tables & fig.)

1937 **621 .43 (.73) & 625 .232 (.73)**
 Railway Mechanical Engineer, January, p. 8.
Four new Zephyrs for the Burlington. (6 500 words, tables & fig.)

1937 **62. (01 & 621 .13**
 Railway Mechanical Engineer, January, p. 17.
WILLIAMS (F. H.). — Failures of locomotive parts. (2 000 words & fig.)

1937 **385 .114 (.73) & 621 .43 (.73)**
 Railway Mechanical Engineer, January, p. 20.
HATCH (P. H.). — Operating experience with the New Haven Comet. (6 600 words & tables.)

Railway Signaling. (Chicago.)

1937 **313 : 656 .25 (.73)**
 Railway Signaling, January, p. 15.
Signaling construction increased during 1936. (6 400 words, tables & fig.)

1937 **625 .162 (.73) & 656 .259 (.73)**
 Railway Signaling, January, p. 25.
Highway traffic retarding-barriers on the Boston Maine. (6 700 words & fig.)

1937 **656 .256.3 (.73)**
 Railway Signaling, January, p. 30.
New automatic signaling on the Frisco. (5 000 words & fig.)

1937 **656 .258 (.71)**
 Railway Signaling, January, p. 34.
Automatic interlocking in Canada. (3 400 words & fig.)

1937 **656 .25 (.73)**
 Railway Signaling, January, p. 39.
Gages for mechanical locking. (2 400 words & fig.)

The Locomotive. (London.)

1937 **621 .132.3 (.42)**
 The Locomotive, N° 534, February 15, p. 32.
Modified passenger engines, L. M. S. R. (800 words & fig.)

1937 **621 .132.3 (.73)**
 The Locomotive, N° 534, February 15, p. 37.
Semi-streamlined locomotive, Delaware, Lackawanna, and Western R. R. (600 words & fig.)

1937 **621 .33 (.438)**
 The Locomotive, N° 534, February 15, p. 38.
Electrification of Polish State Railways. (1 200 words & fig.)

1937 **621 .132.8 (.73)**
 The Locomotive, N° 534, February 15, p. 40.
Besler two-car steam train. (1 300 words & fig.)

1937 **621 .13 (0 (.42)**
 The Locomotive, N° 534, February 15, p. 42.
MORRIS (O. J.). — Standardizing Southern Railway Locomotives, Central section. (1 500 words & fig.). (*To be continued.*)

1937 **621 .132.3 (.42)**
 The Locomotive, N° 534, February 15, p. 48.
New L. N. E. R. streamlined « Pacific » locomotive ;
The « Golden Eagle ». (300 words & fig.)

1937 **625 .154**
 The Locomotive, N° 534, February 15, p. 55.
The development of the locomotive turntable. (3 500 words & fig.)

1937 **625 .175 (.42)**
 The Locomotive, N° 534, February 15, p. 58.
Petrol car for maintenance of track, L. N. E. Ry. (1 400 words & fig.)

The Oil Engine. (London.)

1937 **621 .43 (.81)**
 The Oil Engine, February, p. 302.
New British railcars for Brazil. (1 400 words & fig.)

1937 **621 .43 (.73) & 625 .232 (.73)**

The Oil Engine, February, p. 304.

MANN (C. F.). — 1 800 b. h. p. seven-car unit trains. (1 200 words & fig.)

1937 **621 .43 (.43)**

The Oil Engine, February, p. 305.

Railcars for pleasure trips. (600 words & fig.)

1937 **621 .43 (.42)**

The Oil Engine, February, p. 310.

Trailer-hauling railcar for the G. W. R. (1 600 words & fig.)

1937 **621 .43 (.73)**

The Oil Engine, February, p. 315.

MANN (C. F.). — High-powered short streamlined trains. (1 000 words & fig.)

In Italian.

Annali dei lavori pubblici. (Roma.)

1937 **721 .1**

Annali dei lavori pubblici, gennaio, p. 13.

STRAUB (G.). — Sul coefficiente di sottofondo. (2 600 parole & fig.)

1937 **625 .13**

Annali dei lavori pubblici, gennaio, p. 20.

PAOLINA (E.). — Su di un tipo di galleria urbana a due piani. (2 300 parole & fig.)

La tecnica professionale. (Firenze.)

1937 **621 .335 (.45)**

La tecnica professionale, febbraio, p. 34.

RISSONE (S.). — Le automotrici elettriche a 3 000 volt gr. E. 624 (003 a 008). (3 500 parole & fig.)

L'Ingegnere. (Roma.)

1937 **624 .2**

L'Ingegnere, gennaio, p. 1.

GOSSI (A.) & CARLUCCI (P.). — Sul calcolo delle deformazioni delle travi. (3 500 parole, 6 tabelle & fig.)

Rivista tecnica delle ferrovie italiane. (Roma.)

1937 **656 .211.5 (.45)**

Rivista tecnica delle ferrovie italiane, 15 gennaio, p. 8.

FAVA (A.). — Coperture metalliche nel nuovo fabbricato viaggiatori della stazione di Firenze S. M. N. (2 200 parole & fig.)

1937

Rivista tecnica delle ferrovie italiane, 15 gennaio, p.

MARIANI (R.) & FASOLI (M.). — Il nuovo apparecchio di tipo F. S. per la variazione del rapporto moltiplicazione della **timoneria del freno**. (1 600 role & fig.)

1937

621 .116

Rivista tecnica delle ferrovie italiane, 15 gennaio, p.

MICHELUCCI (A.). — Il **trattamento dell' acqua alimentazione** delle caldaie della Centrale Termica Milano nuova stazione viaggiatori. (4 300 parole, 2 vole & fig.)

1937

625 .2

Rivista tecnica delle ferrovie italiane, 15 gennaio, p.

FORTE (G.). — La cassa del **carro ferroviario** suo isolamento e nelle sue chiusure. (3 800 parole & fig.)

1937

656 .211.7 (.42 + .4)

Rivista tecnica delle ferrovie italiane, 15 febbraio, p.

La Gran Bretagna ed il Continente. Un nuovo servizio di **ferry-boats**. (5 900 parole & fig.)

1937

621 .337 & 621 .1

Rivista tecnica delle ferrovie italiane, 15 febbraio, p.

MASCINI (A.). — **Apparecchiatura di garanzia** della presenza attiva del guidatore sulle locomotive elettriche ed automotrici. (5 400 parole.)

1937

624 .1

Rivista tecnica delle ferrovie italiane, 15 febbraio, p.

LO CIGNO (E.). — Sul calcolo delle **strutture telaio a sezione variabile**. (7 000 parole & fig.)

In Dutch.

De Ingenieur. (Den Haag.)

1937

De Ingenieur, N° 6, 5 Februari, p. Bt. 5.

MAUTNER (K. W.). — **Spannbeton nach System Freyssinet**. (5 800 woorden & fig.)

Spoor- en Tramwegen. (Utrecht.)

1937

385 .113 (.49)

Spoor- en Tramwegen, N° 3, 2 Februari, p. 49.

REITSMA (M. I.). — De opbrengsten van het **reizigersvervoer** der Nederlandsche Spoorwegen. (3 800 woorden.)

1937

625 .163 (.49)

Spoor- en Tramwegen, N° 3, 2 Februari, p. 57.

LEOPOLD (G.). — De **stationsversiering** der Nederlandsche Spoorwegen in 1936. (1 700 woorden & fig.)

1937 **656. (.492)**
 poor- en Tramwegen, N^o 4, 16 Februari, p. 69.
 Vrijheid en gebondenheid in het wegverkeer. (3 200
 woorden & fig.)

1937 **621 .43 (.489)**
 poor- en Tramwegen, N^o 4, 16 Februari, p. 79.
 VAN MAANEN (J.). — Motortractie in Denemarken.
 1 800 woorden & fig.)

In Portuguese.

Gazeta dos caminhos de ferro. (Lisboa.)
1937 **625 .144.2**
 Gazeta dos caminhos de ferro, N^o 1178, 16 de janeiro,
 p. 53.
 TAVARES DOS SANTOS (M.). — A via férrea mo-
 derna e os novos métodos de rectificação das curvas.
 3 000 palavras & fig.)

1937 **621 .135.4 & 625 .215**
 Gazeta dos caminhos de ferro, N^o 1179, 1 de fevereiro,
 p. 78.
 GALLO (J.). — Estudo das condições necessarias
 para conveniente inscrição nas curvas, do material cir-
 culante de dois e três rodados. (1 200 palavras & fig.)

In Polish.
 (= 91.885)

Inżynier Kolejowy. (Warszawa.)

1937 **625 .14 (01 = 91 .885)**
 Inżynier Kolejowy, N^o 1, p. 7.
 KARASINSKI (L. de). — Plane deformations of
 rails relatively to their flexible continuons seating.
 (5 000 words & fig.)

1937 **625 .17 = 91 .885**
 Inzyner Kiolejowy, N^o 1, p. 15 ; N^o 2, p. 68.
 JACYNA (W.). — Calculating permanent way main-
 tenance work. (8 000 words & fig.)

1937 **621 .33 (.438) = 91 .885**
 Inżynier Kolejowy, N^o 2, p. 50.
 PLEWAKO (S.). — Electric trains in service on the
 Warsaw suburban lines. (4 800 words & fig.)

1937 **625 .216 = 91 .885**
 Inżynier Kolejowy, N^o 2 p. 74.
 ZURAKOWSKI (S.). — Investigation into breakages
 of buffer springs and drawbar springs. (2 300 words
 & fig.)

MONTHLY BIBLIOGRAPHY OF RAILWAYS ⁽¹⁾.

PUBLISHED UNDER THE SUPERVISION OF

P. GHILAIN,

General Secretary of the Permanent Commission of the International Railway Congress Association.

(MAY 1937)

[016.385. (02)]

I. — BOOKS.

In French.		
1937	625 .6 (.493)	
JACOBS (L.).		
La Société Nationale des Chemins de fer vicinaux de Belgique.		
Bruxelles, S. N. C. F. V. B., rue de la Science. 1 volume, 45 pages et figures.		
1937	385. (08 (.44)	
Rapport du Conseil d'Administration et de la Commission de vérification des comptes de la Compagnie du Chemin de fer de Paris à Orléans. Assemblée Générale des Actionnaires (19 mars 1937).		
Paris, Secrétariat de la Compagnie. 1 fascicule, 77 pages.		
1937	656 .222	
TONGAS (Ph.).		
Etude théorique de la marche d'un train. Résolution graphique du cas de la traction avec moteurs à vitesse constante à l'aide d'un nomogramme à points alignés.		
Paris, R. G. E., 12, place de Laborde. 1 fascicule, 8 pages et figures.		
In German.		
1937	624 .2	
INGER (G.)		
Zehnteilige Einflusslinien für durchlaufende Träger.		
Berlin, Wilhelm Ernst und Sohn. 1 Band. 118 Seiten. Preis : 10 R.M.)		
1936	625 .13	
ARTMANN.		
Tunnelbau.		
Berlin, Wilhelm Ernst und Sohn. 1 Band.		
1936	624 .8	
AURANEK (A.).		
Bewegliche Brücken.		
Berlin, Julius Springer, 1 Band. 298 Seiten. 15 Tafeln id 412 Bildern. (Preis : 48 R.M.)		
1936		669 .1
OBERHOFFER (P.).		
Das technische Eisen.		
Berlin, Julius Springer. 1 Band, 642 Seiten, 25 Zahlentaf. & 762 Bildern. (Preis : 57 R.M.)		
1936		62. (01
RATZERSDORFER (J.).		
Die Knickfestigkeit von Stäben und Stabwerken.		
Wien, Julius Springer, 1 Band, 321 Seiten und 151 Bildern. (Preis : 28.80 R.M.)		
1936	656 .2 (02	
SOMMERLATTE und MOORMANN.		
Leitfaden für den Verkehrsdienst. Teil 2 : Das Abfertigungs- und Abfertigungskassenwesen.		
Berlin, Julius Springer. 1 Band, 210 Seiten, 11 Anlagen. (Preis : 2 R.M.)		
1937		621 .116
WESCHE (H.).		
Die Brennstoffe.		
Stuttgart, Enke, Ferdinand. 1 Band, 46 Zahlentafeln und 108 Abbildungen. (Preis : 12.60 R.M.)		
1936		621 .392
WOLFGANG LESSEL.		
Die Schlauchelektrode zur Lichtbogenschweissung von Kupfer.		
Berlin, V. D. I. Verlag. 1 Band. (Preis : 3.80 R.M.)		
In English.		
1937	656 .256.2 (.73)	
American Railway signaling principles and practices.		
— Manual and controlled manual block systems and fundamental theory of direct current.		
New York. The Signal Section, A. A. R., 30 Vesey-street. (Price : 35 cents.)		
1937	621 .133.1 (06	
Annual proceedings of the International Railway Fuel Association and the Traveling Engineer's Association.		
Chicago, Ill., U. S. A. : Offices of the Associations.		

(1) The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress conjointly with the Office Bibliographique International, of Brussels. (See « Bibliographical Decimal Classification as applied to Railway Science », by L. WEISSENBRUCH, in the number for November 1897, of the *Bulletin of the International Railway Congress*, 1909).

1937 **62. (01 & 669**
Cutting of Metals. — A bibliography of 800 references which gives access to important articles appearing in the technical literature, and dealing with the use and properties of cutting fluids, machinability of metals, and cutting processes. Period covered 1866 to 1930.

New York : The American Society of Mechanical Engineers. (Price : \$ 1.25.)

1936 **385. (093 (.42)**
DENDY MARSHALL (C. F.).

A history of the Southern Railway.

London : The Southern Railway Company. (Price : 17 s. 6 d.)

1937 **62. (01 & 669**
Effect of temperature upon the properties of metals. — The 600 annotated references in this publication cover tension and compression, creep, torsion, hardness, impact, fatigue, deformation, elasticity, embrittlement, stability, density, wear-sizing, corrosion, oxidation, design, construction, operation, apparatus and methods. Period covered 1828 to 1931.

New York : The American Society of Mechanical Engineers. (Price : \$ 1.25.)

1937 **62. (01 & 669**
EVANS (U. R.).

Metallic corrosion, passivity and protection.

London : Ed. Arnold and Co, Ltd., 41, Maddox-street, W. 1. (Price : 45 s. net.)

1937 **385 .113 (.42)**
Financial and operating results of the British Group Railways in 1936. — Supplement to the Railway Gazette. London, March, 26. (32 pp.)

1937 **621 .31**
GAFFERT (G. A.).

Steam power stations.

London : Mc Graw-Hill Publishing Company, Limited. (Price : 25 s.)

1937 **621 .1 & 621 .43**
GRAIG (D. P.) and ANDERSON (H. J.).

Steam power and internal-combustion engines. Second edition.

London : Mc Graw-Hill Publishing Company, Limited. (Price : 25 s.)

1937 **62. (01 & 669**
Heat transfer. — This pamphlet-publication presents the results of the experiences of eighteen engineers in dealing with problems involved in the transfer and flow of heat. Included in the book are much reliable data hitherto unpublished, as well as a review of recent contributions to the subject.

New York : The American Society of Mechanical Engineers. (Price : \$ 1.60.)

1937 **62. (01 & 669**
LEA (F. C.).

Hardness of metals.

London : Charles Griffin and Co., Ltd. Medium 8 v pp. vi + 141. (Price : 12 s. 6 d.)

1937
LEWITT (E. H.).

Thermodynamics applied to heat engines. Second edition.

London : Sir Isaac Pitman and Sons, Ltd., Parker street, W. C. 2. (Price : 12 s. 6 d. net.)

1937 **669**
MACDONALD (A. C.).

The case-hardening of steel.

London : The Draughtsman Publishing Company, Ltd 96, St. George's-square, S. W. 1. (Price : 2 s. net.)

1937 **62. (01 & 669**

Mechanical springs. — For those interested in problems of mechanical spring design, the 600 references in this bibliography will bring to their attention important articles dealing with design, materials, manufacture specifications, testing and application of mechanical springs. Literature reviewed extends from 1678 to 1927.

New York : The American Society of Mechanical Engineers. (Price : \$ 1.25.)

1937 **621 .131**
PATRICK (D.).

Steam locomotive design.

London : The Draughtsman Publishing Co. Ltd., 96 St. George's Square, S. W. 1. (8 1/2 in. × 5 1/2 in. 92 pp. Illustrated (Price : 4 s. 0 d. net).)

1937 **656 .250**
Pneumatic tyred railcars in Great Britain : Solenoid Operated Disc Signals : D. C. Relays : A. C. Relays.

London : The Westinghouse Brake & Signal Co., Ltd 82, York Road, King's Cross, N° 1.

1937 **669**
SISCO (F. T.).

Alloys of iron and carbon. Vol. II : Properties.

London : Mc Graw-Hill Publishing Company, Ltd. Aldwych House, W. C. 2. (Price : 45 s. net.)

1937 **669**
STRONG (R. A.), SWARTZMAN (E) and BURROUGHS (E. J.).

Fuel briquetting.

Canada : Department of mines and resources, Ottawa (Price : 25 cents net.)

1937 **385. (093 (.73)**
The story of a pioneer : The Florida East Coast Railway. — St. Augustine, Florida, published by the Receivers of the Florida East Coast Railway. (8 3/4 in. × 5 3/4 in.) 32 pp. Gratis.

[016.385. (05)]

II. — PERIODICALS.

In French.

Annales des travaux publics de Belgique. (Bruxelles.)

1937 **62. (01 & 691**
Annales des travaux publics de Belgique, février, p. 9.
DUTRON (R.). — Déformations lentes du béton et
du béton armé sous l'action des charges permanentes.
(17 000 mots, tableaux & fig.)

1937 **62. (01 & 691**
Annales des travaux publics de Belgique, février, p. 143.
BYLS (A.) & CAMPUS (F.). — Les effets des basses
températures sur la prise et le durcissement des bétons.
(5 000 mots.)

1937 **62. (01 & 691**
Annales des travaux publics de Belgique, février, p. 155.
RABOZEE (H.). — Le retrait du béton armé. (2 000
mots.)

Bulletin de l'Association française des Amis des Chemins de fer (Paris).

1937 **621 .138.1**
Bull. de l'Assoc. française des amis des Ch. de fer.
mars, p. 45.
MARTIN (C.). — La vie d'un grand Dépôt. (2 000
mots & fig.)

Bulletin de l'Union internationale des chemins de fer. (Paris.)

1937 **656 .1 (.3)**
Bull. de l'Union Intern. des Ch. de fer, février, p. 41.
La circulation des automobiles dans le monde. (2 800
mots & 4 tableaux.)

1937 **385 .113 (.437)**
Bull. de l'Union Intern. des Ch. de fer, février, p. 46.
Les Chemins de fer de l'Etat tchécoslovaque de 1933
à 1935. (4 200 mots.)

1937 **621 .33 (.3)**
Bull. de l'Union Intern. des Ch. de fer, février, p. 51.
L'électrification des Chemins de fer des principaux
pays en 1936. (4 500 mots.)

1937 **385 (.51)**
Bull. de l'Union Intern. des Ch. de fer, février, p. 57.
Les Chemins de fer de la République de Chine. (6 400
mots & carte.)

Bulletin des transports internationaux par chemins de fer. (Berne.)

1937 **313 .385 (.44)**
Bull. des Transp. Intern. par Ch. de fer, mars, p. 111.
Statistique des Chemins de fer français. (Tableaux.)

Bulletin technique de l'Union professionnelle des Inspecteurs techniques et des chefs de section des chemins de fer belges. (Bruxelles.)

1937 **625 .143.3**
Bull. tech. de l'Union profes. des Inspecteurs tech. et
des Chefs de section des Ch. de fer belges, 15 mars,
p. 1.
LHOEST (L.). — Ecrasement des abouts des rails.
(4 500 mots & fig.)

1937 **625 .143.4**
Bull. tech. de l'Union profes. des Inspecteurs tech. et
des Chefs de section des Ch. de fer belges, 15 mars,
p. 14.
VERLINDEN (A.). — Contribution à l'étude ten-
dant à la suppression des joints. Calcul des contraintes
maxima dans les rails dont les joints seraient tous sou-
dés. (1 600 mots & fig.)

Electricité. (Paris.)

1937 **621 .392**
Electricité, février, p. 80.
Quelques remarques sur les caractéristiques des
postes de soudure à l'arc. (700 mots.)

1937 **625 .62**
Electricité, février, p. 81.
HENRIOD (M.). — Le tramway est-il mort ? (2 600
mots & fig.)

1937 **621 .137 & 621 .32**
Electricité, février, p. 95.
L'électricité à bord des locomotives à vapeur. (2 400
mots & fig.)

Génie civil. (Paris.)

1937 **625 .216**
Génie Civil, N° 2846, 27 février, p. 205.
Les derniers perfectionnements en matière d'attelage
automatique des wagons : L'appareil Boirault-Compact.
(2 300 mots & fig.)

1937 **691**
Génie Civil, N° 2846, 27 février, p. 229.
Influence de la température sur le durcissement des
bétons de ciment. (1 500 mots & fig.)

1937

625 .5

Génie Civil, N° 2847, 6 mars, p. 234.

HUNZIKER. — Les capacités de transport des téléferiques et des funiculaires sur rails. (1 400 mots.)

1937

62. (01 & 669

Génie Civil, N° 2848, 13 mars, p. 252.

Les machines à essayer les métaux pour déterminer la résistance d'endurance. (1 600 mots & fig.)

1937

624 .92

Génie Civil, N° 2848, 13 mars, p. 254.

LANG (H.). — Remarques sur la possibilité de compenser l'affaiblissement par les trous de rivets des pièces de charpente métallique. (600 mots & fig.)

1937

624 .51 (.73)

Génie Civil, N° 2849, 20 mars, p. 261.

Le pont suspendu de 1280 mètres de portée, de la Porte d'Or, à San Francisco. (4 200 mots & fig.)

1937

662

Génie Civil, N° 2849, 20 mars, p. 266.

BERTHELOT (Ch.). — La fabrication de combustibles liquides par traitement des combustibles solides par des solvants. Procédé Pott et Broche. (3 400 mots & fig.)

1937

669 .1

Génie Civil, N° 2849, 20 mars, p. 272.

PORTEVIN (A.) & CHEVENARD (P.). — Les transformations au refroidissement des aciers. (1 300 mots.)

L'Allègement dans les Transports. (Lucerne.)

1937

625 .2 & 669

L'Allègement dans les transports, mars-avril, p. 35.

SUTTER (K.). — Quelques applications récentes de l'aluminium dans la construction du matériel roulant de chemins de fer. (1 300 mots & fig.). (A suivre.)

1937

625 .4 (.45)

L'Allègement dans les transports, mars-avril, p. 41.

HUG (Ad. M.). — Le téléferique San Remo-Monte Bignone. (1 200 mots & fig.). (A suivre.)

La Technique moderne. (Paris.)

1937

625 .172

La Technique moderne, N° 5, 1^{er} mars, p. 161.

Recherche des défauts internes des rails par la méthode Sperry. (1 600 mots & fig.)

1937

62. (01

La Technique moderne, N° 7, 1^{er} avril, p. 225.

BERGERON (L.). — Calcul des déformations et des surcharges dues aux chocs, par généralisation de la méthode graphique de calcul des coups de bélier. (6 000 mots & fig.)

La Traction Électrique. (Paris.)

1937

621 .

La Traction Electrique, septembre-octobre, p. E. 3

PARODI (H.). — Le chemin de fer et la traction électrique. (3 600 mots.)

1937

621 .33 (.49

La Traction Electrique, septembre-octobre, p. E. 3

DUQUESNE (E.). — L'électrification de la ligne Bruxelles-Anvers de la Société Nationale des Chemins de fer belges avec le courant continu à 3 000 volts (6 400 mots & fig.). (A suivre.)

1937

621 .43 (.4

La Traction Electrique, septembre-octobre, p. E. 3

Les automotrices Diesel-électriques Decauville-Oerlikon de 600 ch. du P. L. M. (800 mots & fig.)

Les Chemins de fer et les Tramways. (Paris)

1937

621 .335 (.4

Les Chemins de fer et les Tramways, février, p. 22.

La nouvelle locomotive électrique du Paris-Orléans Type E. 703.2-D-2 à grande vitesse. (2 500 mots.)

1937

621 .43 (.4

Les Chemins de fer et les Tramways, février, p. 25.

La nouvelle « Michelin », type 23 à 3 bogies, 400 C.V. (1 200 mots & fig.)

1937

621 .

Les Chemins de fer et les Tramways, février, p. 29.

Moteurs à deux temps à induction harmonique. (1 200 mots.)

1937

621 .135.4 & 625 .2

Les Chemins de fer et les Tramways, février, p. 3

RACZ (E.). — Marche en courbe du matériel des chemins de fer. Détermination des efforts en résultant sur les châssis et bogies. (1 800 mots & fig.)

1937

656 .2

Les Chemins de fer et les Tramways, février, p. 34.

MONTAGNÉ. — La signalisation des passages à niveau. (1 800 mots & fig.)

1937

621 .132.8 & 621 .

Les Chemins de fer et les Tramways, février, p. 37.

Locomotive Diesel. — S. A. Sulzer Frères. (2 400 mots & fig.)

1937

621 .392 & 625 .1

Les Chemins de fer et les Tramways, février, p. 40.

Le rechargement des croisements de rails. (3 800 mots.)

1937

621 .

Les Chemins de fer et les Tramways, mars, p. 59.

KEULEYAN (L.). — Nouveaux moteurs Diesel pour la traction. (3 000 mots & fig.)

1937 **621 .134.1**
Les Chemins de fer et les Tramways, mars, p. 65.
Perfectionnements aux pistons. (2 400 mots & fig.)

1937 **625 .23 (.44)**
Les Chemins de fer et les Tramways, mars, p. 68.
Les rames légères de la Compagnie du Nord. (400 mots.)

1937 **385. (09 (.61)**
Les Chemins de fer et les Tramways, mars, p. 69.
Les Chemins de fer en Tunisie. (2 100 mots & carte.)

1937 **625 .216**
Les Chemins de fer et les Tramways, mars, p. 73.
Un dispositif italien d'attelage automatique. (1 000 mots & fig.)

L'Industrie des voies ferrées et des transports automobiles. (Paris.)

1937 **621 .43**
L'Ind. des voies ferrées et des transp. autom., février, p. 24.
ZENS (P.). — La suralimentation des moteurs à injection. (3 000 mots & fig.)

L'Ossature métallique. (Bruxelles.)

1937 **624 .2**
L'Ossature métallique, mars, p. 125.
BAES (L.). — La poutre Vierendeel. Méthode de calcul par ouverture des mailles par sectionnement d'une des membrures. (7 000 mots & fig.)

Revue générale des chemins de fer. (Paris.)

1937 **656 .225 & 656 .261**
Revue Générale, mars, p. 155.
DRUGEON. — Les containers en 1936. (10 700 mots & fig.)

1937 **385 .4 (.44) & 385 .587 (.44)**
Revue Générale, mars, p. 180.
FLEUROT. — Un aspect de la fusion, au Mans, des arrondissements. Exploitation-Traction-Voie. Les bureaux de l'arrondissement commun. (4 300 mots & fig.)

1937 **621 .134.3**
Revue Générale, mars, p. 188.
DATCHARRY. — La réparation des éléments surchauffeurs de locomotives dans les ateliers des chemins de fer de l'Est. (1 500 mots & fig.)

Traction nouvelle. (Paris.)

1937 **621 .43 (.44)**
Traction Nouvelle, mars-avril, p. 42.
CHATEL (M.). — Les automotrices des Aciéries du Nord. (4 500 mots & fig.)

1937 **621 .43 (.44)**
Traction Nouvelle, mars-avril, p. 50.
HARRAND (G.). — Les services d'autorails rapides des Chemins de fer de l'Est. (2 300 mots & fig.)

1937 **621 .43 (.492)**
Traction Nouvelle, mars-avril, p. 54.
HUPKES (W.). — L'expérience hollandaise sur les 40 rames triples Diesel électriques. (3 700 mots & fig.)

1937 **621 .43**
Traction Nouvelle, mars-avril, p. 67.
LABARTHE (A.). — L'étude scientifique des moteurs Diesel. (2 800 mots & fig.)

In German.

Archiv für Eisenbahnwesen. (Berlin.)

1936 **656. (.73)**
Archiv für Eisenbahnwesen, November-Dezember, S. 1247.
GRETSCH (R.). — Zum Schlussbericht des Federal Coordinator of Transportation über den Personenverkehr. (11 000 Wörter & Tafeln.)

1936 **656 .1 (.43)**
Archiv für Eisenbahnwesen, November-Dezember, S. 1279.
JÜSGEN (W.). — Reichsautobahnen und Steuerrecht. (17 000 Wörter.)

1936 **385 .517 (.43)**
Archiv für Eisenbahnwesen, November-Dezember, S. 1355.
LAMBSDORFF & KUHATSCHECK. — Die Reichsbahnversicherungsanstalt, die Reichsbahnbetriebskrankenkassen, die Angestellten-, Unfall- und Arbeitslosenversicherung bei der Deutschen Reichsbahn im Jahr 1935. (9 500 Wörter.)

1936 **385 .113 (.492)**
Archiv für Eisenbahnwesen, November-Dezember, S. 1381.
Die Niederländischen Eisenbahnen in den Jahren 1934 und 1935. (10 000 Wörter.)

1936 **385. (09 (.485)**
Archiv für Eisenbahnwesen, November-Dezember, S. 1415.
PASZKOWSKI. — Die Entwicklung der Schwedischen Staatsbahn in den Jahren 1934 und 1935. (6 000 Wörter.)

Die Lokomotive. (Wien.)

1937 **621 .132.5 (.68)**
Die Lokomotive, Februar, S. 21.
2 D I Heissdampflokomotive Klasse 15 E der Südafrikanischen Staatsbahnen. (1 900 Wörter & Abb.)

1937 **621 .131.2 (.44)**
Die Lokomotive, Februar, S. 23.
Umbauverfolge an den 2 C, 2 C 1 und 2 D 1 Lokomotiven der Französischen Ostbahn. (3 300 Wörter & Abb.)

1937 **621 .132.3 (.436)**
Die Lokomotive, März, S. 37.
SEIDL (O.). — 1-D-2 Heissdampf-Zwillings-Schnellzugslokomotive Reihe 214 der Oe. B. B. (3. Lieferung). (2 200 Wörter & Abb.)

1937 **621 .33 (.436)**
Die Lokomotive, März, S. 41.
Weitere **Elektrifikation** der Oesterreichischen Bundesbahnen. (1 400 Wörter.)

Die Reichsbahn. (Berlin.)

1937 **656 .29**
Die Reichsbahn, Heft 10, 10. März, S. 225.
STEFFAN. — Strassenverkehrsunfälle durch Dampf oder Rauch von Lokomotiven. (2 400 Wörter.)

1937 **656 .237 (.43)**
Die Reichsbahn, Heft 11, 17. März, S. 235.
SCHREIBER. — Die neue **Rechnungsvorschrift über Leistungen** für die Deutsche Reichsbahn (Relei). (5 500 Wörter.)

Elektrische Bahnen. (Berlin.)

1937 **621 .33 (.43)**
Elektrische Bahnen, Januar, S. 2.
WECHMANN (W.). — Der **elektrische Zugbetrieb** der Deutschen Reichsbahn im Jahre 1936. (3 000 Wörter & Abb.)

1937 **621 .33**
Elektrische Bahnen, Januar, S. 5.
MIROW (I.). — **Nutzbremmung** bei Einphasen-Wechselstrom-Bahnen. (6 000 Wörter & Abb.)

1937 **621 .337**
Elektrische Bahnen, Januar, S. 20.
MÜLLER (J.). — Das **Triebmoment bei der Bewegung des Achsenkuppelpunktes** des Dreistangenantriebes ohne Kulisze. Bauart Bianchi & Kandó. (3 800 Wörter & Abb.)

1937 **621 .332**
Elektrische Bahnen, Januar, S. 28.
SÜBERKRÜB (M.). — Erfahrungen mit **Isolatoren** im Bahnbetrieb. (800 Wörter, 3 Zahlentafeln & Abb.)

Glasers Annalen. (Berlin.)

1937 **625 .253**
Glasers Annalen, Heft 4, 15. Februar, S. 40.
MÖLLER (E.). — **Bremsbeschleuniger für Druckluftbremsen**, Einfachbeschleuniger und Koppelbeschleuniger. (4 000 Wörter & Abb.)

1937 **621 .9, 621 .138.5 & 625**
Glasers Annalen, Heft 5, 1. März, S. 49.
WILCKE. — **Neuzeitliche Werkzeugmaschinen** in Eisenbahnwerkstätten. (4 700 Wörter & Abb.)

Organ für die Fortschritte des Eisenbahnwesens (Berlin.)

1937 **656**
Organ für die Fortschr. des Eisenbahnw. Heft 1. März, S. 77.
KLEIN (R.). — Die Ermittlung der kürzesten **Fahrzeit** auf mechanisch dynamischer Grundlage. (6 000 Wörter, 2 Tafeln.)

1937 **656**
Organ für die Fortschr. des Eisenbahnw. Heft 1. März, S. 85.
KOTHE (H.). — **Rechentafel zur Fahrzeitermittlung.** (2 000 Wörter & Abb.)

1937 **621 .43 & 625**
Organ für die Fortschr. des Eisenbahnw. Heft 1. März, S. 89.
SCHULZE (H.). — Eine neue **Drehgestellsenke** Triebwagen. (1 000 Wörter & Abb.)

1937 **621 .43 (.43) & 625 .26**
Organ für die Fortschr. des Eisenbahnw. Heft 15. März, S. 93.
OSTHOFF. — **Fliessbetrieb mit Schienenfahrzeugen** in Eisenbahnbetriebswerken. (7 500 Wörter.)

1937 **625 .244**
Organ für die Fortschr. des Eisenbahnw. Heft 15. März, S. 101.
TASCHINGER (O.). — Neue **Reichsbahn-Kühler** für 90 km/h Geschwindigkeit. (4 300 Wörter & Abb.)

1937 **621**
Organ für die Fortschr. des Eisenbahnw. Heft 15. März, S. 106.
PFLANZ (K.). — Untersuchungen am **Federungsaggregat** gleich einer elektrischen Schnellzugslokomotive. (2 000 Wörter & Abb.)

Zeitschrift des Vereines Deutscher Ingenieure (Berlin.)

1937 **62.**
Zeitsch. des Ver. deutsch. Ing. Nr. 9, 27. Februar, S. 2.
THUM (A.). — Einfluss von **Wärme-Eigenspannungen** auf die Dauerfestigkeit. (2 400 Wörter & Abb.)

1937 **62.**
Zeitsch. des Ver. deutsch. Ing. Nr. 10, 6. März, S. 2.
BERG. — **Dynamische Spannungsmessungen.** (3 000 Wörter & Abb.)

1937 **721 .9**
Zeitsch. des Ver. deutsch. Ing. Nr. 11, 13. März, S. 319.
MAIER-LEIBNITZ (H.). — Stand der **Stahlbauweise**. Theorie und Ausführung. (3 600 Wörter & Abb.)

1937 **721 .9 (.43)**
Zeitsch. des Ver. deutsch. Ing. Nr. 12, 20. März, S. 359.
Neuregelung der zulässigen Spannungen für Stahl im Hochbau. (1 800 Wörter.)

1937 **625 .143. (0)**
Zeitsch. des Ver. deutsch. Ing. Nr. 12, 20. März, S. 363.
Eigenspannungen in Eisenbahnschienen. (800 Wörter & Abb.)

Zeitschrift für das gesamte Eisenbahn-Sicherungswesen. (Berlin.)

1937 **656 .254 (.43)**
Zeitschr. für das ges. Eisenb. Sicherungsw., Nr. 4, 10. März, S. 45.

HOFMANN (F.). — Die **optische Zugbeeinflussung** auf der Strecke Berlin-Stettin. (3 000 Wörter & Abb.)

Zeitung des Vereins mitteleuropäischer Eisenbahnverwaltungen. (Berlin.)

1937 **385. (09 (.489))**
Zeitung des Ver. mitteleurop. Eisenbahnverw., Nr. 9, 4. März, S. 156.

KNUTZEN (P.). — Die **Modernisierung** der Dänischen Staatsbahnen. (4 000 Wörter & Abb.)

1937 **656 .225**
Zeitung des Ver. mitteleurop. Eisenbahnverw., Nr. 10, 11. März, S. 173.

OTTMANN (K.). — Die **Wagenbildung** in Stückgutverkehr. (5 300 Wörter & Abb.)

1937 **656 .21 (01)**
Zeitung des Ver. mitteleurop. Eisenbahnverw., Nr. 11, 18. März, S. 189.

FRÖLICH (E.). — **Betriebslaboratorium**. (3 700 Wörter & Abb.)

In English.

Bengal-Nagpur Railway Magazine (Calcutta).

1937 **385. (09 (.52))**
Bengal-Nagpur Railway Magazine, N° 2, February, p. 3.
The Railroads of Japan. Steel highways in the land of the rising sun. (2 200 words & fig.)

Bulletin, American Railway Engineering Association. (Chicago, Ill.)

1936 **656 .2 (.73)**
Bulletin, Americ. Ry. Engin. Assoc., N° 392, December, p. 381.

Report of Committee on **economics of railway operation**. — Methods for obtaining a more intensive use

of existing railway facilities. Methods or formulae for the solution of special problems relating to more economical and efficient railway operation. Method of determining the effect of a moderate change in traffic density upon the operating ratio of a railway. Train resistance as affected by weight of rail. (14 000 words & fig.)

1936 **625 .11 (.73)**
Bulletin, Americ. Ry. Engin. Assoc., N° 392, December, p. 421.

Report of Committee on **economics of railway location**. — Steam locomotives. Electric locomotives. Forms for calculating the tractive effort and horsepower output of typical electric locomotives—direct current; single phase alternating current and motor generator locomotive. — Etc. (3 500 words & fig.)

1936 **69 (.73) & 72 (.73)**
Bulletin, Americ. Ry. Engin. Assoc., N° 392, December, p. 437.

Report of Committee on **masonry**. — Specifications and principles of design of plain and reinforced concrete progress in the Science and Art of concrete manufacture. Specifications for foundations. Proposed specifications for placing concrete by pumping. Review of A S T M specification C 76-35 T for reinforced concrete culvert pipe. Rating of existing reinforced concrete structures. (7 000 words & fig.)

1937 **65 (.73)**
Bulletin, Amer. Ry. Engin. Assoc., N° 393, January, p. 461.

Report of Committee on **standardization**. — Tabulation of specifications and recommended practices as contained in the manual and supplemental bulletins, which are presented for uniform practice on all Railroads. Standards approved by the American Standards Association. American Standards Association technical projects on which the Association of American Railroads is now cooperating. — Etc. (8 000 words.)

1937 **625 .14 (.73)**
Bulletin, Amer. Ry. Engin. Assoc., N° 393, January, p. 475.

Report of Committee on **track**. — Design of rail-bound frog castings. Fastenings for continuous welding of rail. Extracts of report on « welding rails together in track » by F. R. Layng, Chief Engineer, Bessemer & Lake Erie Railroad. Plans for switches, frogs, crossings, slip switches, etc., and track construction in paved streets. Design of tie plates for R.E. rail sections as developed. Determination of the limiting relative positions of the abutting rails of fixed and drawspans of bridges and proper tolerances. Outline of complete field of work of the committee. Revised designs for cut track spikes. — Etc. (11 000 words & fig.)

1937 **625 .142 (.73)**
Bulletin, Amer. Ry. Engin. Assoc., N° 393, January, p. 513.

Report of Committee on **ties**. Substitutes for wood ties. Best practice from the manufacture of the tie to its installation in track. Effect of different kinds of ballast on life of ties. Outline of complete field of work of the committee. (6 000 words.)

1937 **625 .237 (.42) & 657 (.73)**
Bulletin, Amer. Ry. Engin. Assoc., N° 393, January, p. 525.

Report of Committee on records and accounts. — Bibliography on subjects pertaining to records and accounts. Office and drafting room practice. Recommended practices to be followed with respect to maintenance of way accounts and statistical requirements. Construction reports and records. Methods and forms for gathering data for keeping up to date the property records of railways with respect to valuation, accounting, depreciation and other requirements. — Etc. (10 000 words & fig.)

1937 **385 .4 (.73)**
Bulletin, Amer. Ry. Engin. Assoc., N° 393, January, p. 577.

Report of Committee on rules and organization. — Revision of manual. Outline of complete field of work of the committee. (4 000 words.)

Electrical Industries (London).

1937 **621 .33 (.43)**
Electrical Industries, N° 1873, March 3rd, p. 269.

Developments on the German State Railways. Electric traction proves its worth. (1 200 words, one table & fig.)

Engineer. (London.)

1937 **385. (09 (.68)**
Engineer, N° 4233, February 26, p. 237.
The Rhodesian Railways. (6 000 words & fig.)

1937 **621 .43**
Engineer, N° 4233, February 26, p. 240.

BEALE (E. S.) and STANSFIELD (R.). — High-speed engine indicators. (5 000 words & fig.). (*To be continued.*)

1937 **621 .33**
Engineer, N° 4234, March 5, p. 269.
Main line railway electrification. (3 200 words.)

1937 **625 .214 (.42)**
Engineer, N° 4234, March 5, p. 285.
Roller bearing railway axle-box. (300 words & fig.)

1937 **621 .392**
Engineer, N° 4235, March 12, p. 295.
DE LANGE (S. G. P.). — Characteristics of arc welding machines. (2 000 words & fig.)

1937 **621 .43 (.73)**
Engineer, N° 4236, March 19, p. 323.
Oil engine shunting locomotives in America. (300 words.)

1937 **669. (06 (.42)**
Engineer, N° 4236, March 19, p. 328.
Institute of Metals. — (Meeting held on March 10th and 11th.) — Abstract of five papers with discussion. —

Age hardening. Metal spraying. Rolling properties zinc. Rolled brass strip. Fatigue and corrosion. Fatigue of bronzes. (5 000 words.)

1937 **625 .232 (.42)**
Engineer, N° 4236, March 19, p. 342.
New L. M. S. articulated trains. (700 words.)

1937 **669. (06 (.42)**
Engineer, N° 4237, March 26, p. 356.
Institute of metals. (Meeting held on March 10th and 11th.) Abstract of three papers with discussion. — Stress-strain characteristics of copper, silver and gold. Creep of virgin lead. X-Ray. crystal analysis. (3 000 words.)

1937 **669**
Engineer, N° 4237, March 26, p. 360.
GOUGH (H. J.). — Cast crankshafts. (3 200 words & fig.)

1937 **621 .39**
Engineer, N° 4237, March 26, p. 362.
An arc welding rectifier. (300 words & fig.)

1937 **669**
The Metallurgist, p. 7, Suppl. to the Engineer, February 26.
Phosphorus in steel. (1 600 words & fig.)

1937 **669**
The Metallurgist, p. 9, Suppl. to the Engineer, February 26.
Martensite. (2 400 words & fig.)

1937 **669**
The Metallurgist, p. 11, Suppl. to the Engineer, February 26.
Chromium-manganese steels. (2 400 words & fig.)

1937 **669**
The Metallurgist, p. 13, Suppl. to the Engineer, February 26.
Nitrogen absorption in arc welding. (800 words & fig.)

Engineering. (London.)

1937 **656. (.42)**
Engineering, N° 3711, February 26, p. 236.
Transport in Germany. (2 000 words.)

1937 **625 .214 (.42)**
Engineering, N° 3712, March 5, p. 273.
Timken railway axlebox. (350 words.)

1937 **621 .135.2 & 656 .28**
Engineering, N° 3713, March 12, p. 292.
Locomotive-type failures. (1 100 words.)

1937 **621 .16**
Engineering, N° 3714, March 19, p. 305.
PAGET (A. L.). — Vibration in steam-turbine buckets and damping by impact. (5 600 words & fig.)

1937 **621 .13 (0)**
Engineering, N° 3714, March 19, p. 307.
The engineering outlook. X. — The locomotive industry. (4 400 words & fig.)

1937 **621 .31**
Engineering, N° 3714, March 19, p. 311.
TAYLOR (A. M.). — Ultra long-distance power transmission. (4 000 words & fig.). (*To be continued.*)

1937 **669. (06) (.42)**
Engineering, N° 3714, March 19, p. 322.
The Institute of metals. Theory of age-hardening. Metal spraying. Cast structure and rolling properties of zinc. (3 000 words.)

1937 **625 .232 (.42)**
Engineering, N° 3714, March 19, p. 324.
Articulated trains for the London Midland and Scottish Railway. (900 words & fig.)

1937 **669 .1**
NORBURY (A. L.) and MORGAN (E.). — The effect of non-metallic inclusions on the graphite size of grey cast iron. (5 500 words.)

1937 **669. (06) (.42)**
Engineering, N° 3715, March 26, p. 337.
The Institute of metals. — Rolled brass strip. Fatigue and corrosion. Fatigue tests of bronzes. Stress-strain-characteristics of copper, silver and gold. (4 500 words.)

1937 **621 .31**
Engineering, N° 3715, March 26, p. 354.
TAYLOR (A. M.). — Ultra long-distance power transmission. (3 600 words.)

1937 **62. (01) & 621 .43**
Engineering, N° 3715, March 26, p. 357.
WILLIAMS (C. G.). — Factors influencing wear of valve seats in internal-combustion engines. (1 800 words, tables & fig.). (*To be continued.*)

1937 **621 .16**
Engineering, N° 3715, March 26, p. 358.
Chimney-loss recorder. (1 700 words.)

Engineering News-Record. (New York.)

1937 **624 .1 (.73)**
Engineering News-Record, N° 6, February 11, p. 217.
BERETTA (J. W.). — Drilled, reamed holes for bridge foundation piles. — Cast-in-place piling, adapted from building practice, aids in providing an economical concrete bridge of continuous slab type. (1 200 words & fig.)

1937 **62. (01) & 69**
Engineering News-Record, N° 9, March 11, p. 362.
BYERS (J. E.). — Repairing earthquake damage. (4 000 words & fig.)

1937 **624 .1**
Engineering News-Record, N° 9, March 11, p. 373.
ELLSBERG (E.) and KANDEL (Ch.). — New sheet-pile cutting record set for underwater work. (2 000 words & fig.)

Journal, Institute of Transport. (London.)

1937 **385 .114 (.68), 621 .13 (.68) & 621 .33 (.68)**
Journal, Institute of Transport, N° 5, March, p. 207.
Comparative operation under steam and electric traction on the South African Railways. (7 500 words, tables & fig.)

Journal, Institution of Civil Engineers. (London.)

1937 **691**
Journal, Institution of Civil Engineers, N° 5, March, p. 318.
STEWART (D. A.). — Fundamental research on the application of vibration to the pre-casting of concrete. (12 500 words & fig.)

Journal, Institution of Engineers, Australia. (Sydney, N. S. W.)

1937 **691 & 694**
Journal, Institution of Engineers, Australia, January, p. 2.
JOHNSON (C. G. F.) and CAMPBELL (A. H.). — Concrete control as used at the Mount Bold Dam, South Australia. (11 000 words & fig.)

Journal, Permanent Way Institution. (London.)

1936 **625 .144 & 625 .17**
Journal, Permanent Way Institution, December, p. 255
KETTERINGHAM (R.). — A few observations on permanent way work. (9 000 words.)

1936 **625 .17 & 693**
Journal, Permanent Way Institution, December, p. 273
WALL (W. M.). — Cementation for railway maintenance. (5 000 words & fig.)

1936 **625 .15 & 669 .1**
WILSON (W.). — The manufacture of points, crossings and components. (9 000 words & fig.)

1936 **625 .27**
SIMMERSON (B. J.). — Permanent way material stocks and usage. (5 000 words.)

Journal, Western Society of Engineers. (Chicago.)

1936 **625 .244 (.73)**
Journal, Western Society of Engineers, N° 6, December, p. 344.

SUMAN (R. W.). — The ice slinger and its contribution to long distance movement of perishables. (10 000 words & fig.)

- 1936** **621 .392 (.73), 625 .143 (.73) & 665 .882 (.73)**
Journal, Western Society of Engineers, N° 6, December, p. 361.
WOLFE (J.). — **Track welding practices of the Chicago surface lines.** (8 000 words.)

Mechanical Engineering. (New York.)

- 1937** **62. (01 & 669 .1)**
Mechanical Engineering, N° 3, March, p. 145.
YANT (J. W.). — **Magnaflux inspection of pressure-vessel welds.** (2 600 words.)

- 1937** **62. (01 & 669 .1)**
Mechanical Engineering, N° 3, March, p. 147.
RATHBONE (T. C.). — **Detection of fatigue cracks by magnaflux method.** (4 000 words & fig.)

- 1937** **62. (01 & 669 .1)**
Mechanical Engineering, N° 3, March, p. 153.
CAVANAGH (R. F.). — **Magnaflux inspection of boiler drums and unfired pressure vessels.** (2 000 words & fig.)

- 1937** **621 .13, 621 .33 & 621 .43**
Mechanical Engineering, N° 3, March, p. 163.
Progress in railroad mechanical engineering in 1936 ; developments characterized by higher speeds. (9 000 words & fig.)

- 1937** **62. (01 & 669 .1)**
Mechanical Engineering, N° 3, March, p. 194.
Corrosion-resistant metals. (5 500 words.)

Modern Transport. (London.)

- 1937** **625 .251**
Modern Transport, N° 937, February 27, p. 4.
GRAFF-BAKER (W. S.). — **Retardation of trains.** Measures to improve braking efficiency. (1 600 words.)

- 1937** **656 .25 (.42)**
Modern Transport, N° 937, February 27, p. 5.
PROUD (H. M.). — **Power signalling on Railways.** (1 500 words & fig.)

- 1937** **385 .114 & 621 .43**
Modern Transport, N° 937, February 27, p. 8.
Diesel Traction on Railways. Present working costs. (700 words.)

- 1937** **656 .21 (.42)**
Modern Transport, N° 938, March 6, p. 5.
New methods in L. M. S. goods terminal working. (3 600 words & fig.). (*To be continued.*)

- 1937** **621 .43 (.44)**
Modern Transport, N° 938, March 6, p. 7.
Latest Michelin railcar. A hundred passenger unit. (900 words.)

- 1937** **621 .132.3 (1)**
Modern Transport, N° 938, March 6, p. 9.
Improved locomotives for G. S. Railways. (Ireland) (500 words & fig.)

- 1937** **656 .21 (1)**
Modern Transport, N° 939, March 13, p. 6.
New methods in L. M. S. goods terminal working. (3 300 words & fig.)

- 1937** **656 .211.5 (1)**
Modern Transport, N° 939, March 13, p. 9.
High-speed lifts for London transport. (800 words & fig.)

- 1937** **621 .13**
Modern Transport, N° 940, March 20, p. 2.
Turbine locomotives. (900 words.)

- 1937** **385 .3 (1)**
Modern Transport, N° 940, March 20, p. 6.
KIRKUS (A. E.). — **Ministry of Transport.** I. An outline of its functions. (1 500 words.). (*To be continued.*)

- 1937** **625 .232 (1)**
Modern Transport, N° 940, March 20, p. 7.
Articulated excursion trains for L. M. S. (1 300 words & fig.)

- 1937** **621 .43 (1)**
Modern Transport, N° 940, March 20, p. 9.
Diesel railcars in Italy. — A streamlined three-car unit. (800 words & fig.)

- 1937** **624 .13**
Modern Transport, N° 941, March 27, p. 3.
Rail and road bridge for Latvia. (1 000 words & fig.)

- 1937** **385 .3 (1)**
Modern Transport, N° 941, March 27, p. 5.
KIRKUS (A. E.). — **Ministry of Transport.** II. Its control over the railways. (2 000 words.)

- 1937** **625 .25**
Modern Transport, N° 941, March 27, p. 6.
Taper roller bearing axleboxes. (300 words & fig.)

- 1937** **621 .132.3 (1)**
Modern Transport, N° 941, March 27, p. 7.
Locomotive improvements on Southern Railway. Enlarged boiler for « Lord Howe ». (600 words & fig.)

Proceedings, American Society of Civil Engineers (New York.)

- 1937** **625 .14**
Proceedings, Amer. Society of Civil Engineers, N° 1, February, p. 287.
AFRICANO (A.). — **A new theory of rail expansion.** (5 500 words, tables & fig.)

- 1937** **624 .2**
 Proceedings, Amer. Society of Civil Engineers, N° 2, February, p. 335.
YOUNG (D.). — Analysis of Vierendeel trusses. — Discussion by Messrs. Louis Baes, E. C. Ingalls and Ralph B. Peck, Harold E. Wessman, and A. Floris. (4 000 words & fig.)

Railway Age. (New York.)

- 1937** **656 .284 (.73)**
 Railway Age, N° 6, February 6, p. 248.
Service restored rapidly as Ohio recedes. — Railways provide only escape from many communities—receding waters show limited damage to property. (3 800 words & fig.)

- 1937** **621 .139 (.73), 625 .18 (.73) & 625 .27 (.73)**
 Railway Age, N° 6, February 6, p. 254.
Scrap handling and reclamation big business on Pennsylvania. (2 600 words & fig.)

- 1937** **656 .222.1 (.73)**
 Railway Age, N° 6, February 6, p. 259.
Performance of high-speed trains on the Burlington. (1 500 words.)

- 1937** **625 .142.2 (.73) & 691 (.73)**
 Railway Age, N° 6, February 6, p. 261.
Wood preservers meet at New Orleans. (3 200 words & fig.)

- 1937** **621 .43 (.489)**
 Railway Age, N° 6, February 6, p. 265.
Diesel-electric trains on the Danish State Railways. (1 000 words & fig.)

- 1937** **621 .133.8 (.73)**
 Railway Age, N° 6, February 6, p. 269.
Improved boiler check valve. (200 words & fig.)

- 1937** **656 .211 (.71) & 721 (.71)**
 Railway Age, N° 7, February 13, p. 285.
New passenger station has interesting features. (4 500 words & fig.)

- 1937** **656 .253 (.73)**
 Railway Age, N° 7, February 13, p. 291.
Brake tests on U. P. streamliner. (3 000 words & fig.)

- 1937** **656 .254 (.73)**
 Railway Age, N° 7, February 13, p. 295.
Centralized traffic control on Texas & Pacific. (2 200 words & fig.)

- 1937** **621 .132.3 (.73)**
 Railway Age, N° 8, February 20, p. 319.
Largest streamline steam locomotives. (1 500 words & fig.)

- 1937** **656 .21 (.73) & 725 .31 (.73)**
 Railway Age, N° 8, February 20, p. 323.
Milwaukee develops new plans for small stations. (800 words & fig.)

- 1937** **621 .13 (0)**
 Railway Age, N° 8, February 20, p. 325.
WALLACE (L. W.). — Research results in steam Railway Transport. (4 000 words & fig.)

- 1937** **656 .21 (.73)**
 Railway Age, N° 8, February 20, p. 333.
Typewriting by wire in Chicago. Freight yards of the Milwaukee. (2 000 words & fig.)

- 1937** **697. (.73) & 725 .34 (.73)**
 Railway Age, N° 9, February 27, p. 354.
Air conditioning extended to perishable produce storage. (2 000 words & fig.)

- 1937** **625 .24 (0)**
 Railway Age, N° 9, February 27, p. 361.
RICHARDSON (L.). — Built freight cars to run. (3 000 words & tables.)

- 1937** **656 .261 (.74)**
 Railway Age, N° 9, February 27, p. 364.
Building a rail-highway co-ordination system. Canadian National simplifies tariffs as an aid in recovering merchandise traffic. (2 400 words & fig.)

- 1937** **656. (.42)**
 Railway Age, N° 9, February 27, p. 369.
Rail-highway co-ordination succeeds in England. (2 500 words.)

- 1937** **621 .132.5 (.73)**
 Railway Age, N° 10, March 6, p. 389.
Northern Pacific high-speed freight locomotives. (1 500 words, tables & fig.)

- 1937** **625 .13 (.73)**
 Railway Age, N° 10, March 6, p. 392.
Southern Pacific reinforces ten steel viaducts. (1 600 words & fig.)

Railway Engineering and Maintenance. (Chicago.)

- 1937** **625 .14 & 625 .17**
 Railway Engineering and Maintenance, March, p. 178.
Equipment economies number. — A serie of six articles. — What is ahead for 1937? — Are we out of the « Hand car era? ». — Is there a shortage of work equipment? — Field service. — Keeping work equipment in working order. — Laying a million tons of rail in 1937. (37 000 words & fig.)

Railway Gazette. (London.)

1937 **621 .132 (.42)**
Railway Gazette, N° 8, February 19, p. 318.
British locomotive types — III — Great Western Railway. (10 figures.)

1937 **656 .258 (.44)**
Railway Gazette, N° 8, February 19, p. 321.
New signalling at Lutterbach, Alsace-Lorraine Rys. (1500 words & fig.)

1937 **625 .232 (.942)**
Railway Gazette, N° 8, February 19, p. 324.
All-welded passenger stock in Australia. (1300 words.)

1937 **656. (.43)**
Railway Gazette. N° 8, February 19, p. 330.
Transport in Germany. — Abstract of a paper by Brig. General Sir H. Osborne Mance presented to the Institute of Transport. (3200 words.)

1937 **355. (.42) & 656 .25 (.42)**
Railway Gazette, N° 9, February 26, p. 373.
BIDDULPH (Major F. J.). — System of operating Longmoor military railway. (1400 words.)

1937 **621 .132.8 (.62)**
Railway Gazette, N° 9, February 26, p. 375.
4—6—4 + 4—6—4 Beyer-Garratt locomotives for Sudan. (3200 words & fig.)

1937 **621 .392 (.481) & 624 (.481)**
Railway Gazette, N° 9, February 26, p. 381.
Big welded railway bridge in Norway. (200 words.)

1937 **625 .245 (.42)**
Railway Gazette, N° 9, February 26, p. 382.
G. W. R. vehicles for exceptional loads — I. (100 words & fig.)

1937 **621 .132.1 (.42)**
Railway Gazette, N° 10, March 5, p. 416
British locomotives types — IV, London Midland & Scottish Railway. (6 figures.)

1937 **385 .586 (.54)**
Railway Gazette, N° 10, March 5, p. 419.
DEAN (V. L.). — The Walton Training School, North Western Railway, India. (4200 words.)

1937 **656 .212 (.42)**
Railway Gazette, N° 10, March 5, p. 423.
Modernising goods depots on the L. M. S. R. (4800 words & fig.)

1937 **625 .245 (.42)**
Railway Gazette, N° 10, March 5, p. 433.
G. W. R. vehicles for exceptional loads — II. (4 figures.)

1937 **621 .132.1 (.42)**
Railway Gazette, N° 11, March 12, p. 481.
British locomotives types — V, London Midland & Scottish Railway. (6 figures.)

1937 **656 .261 (.42)**
Railway Gazette, N° 11, March 12, p. 487.
Mechanical Department of a great carrying firm (2400 words & fig.)

1937 **621 .132.8 (.73) & 625 .232 (.73)**
Railway Gazette, N° 11, March 12, p. 495.
A new American steam rail motor train. (1500 words & fig.)

1937 **625 .245 (.42)**
Railway Gazette, N° 11, March 12, p. 497.
G. W. R. vehicles for exceptional loads — III. (2 figures.)

1937 **621 .135.2 & 625 .232**
Railway Gazette, N° 12, March 19, p. 531.
White bearing metals for heavy duty. II. — Performance of finished bearings. (1700 words & fig.)

1937 **621 .132.1 (.42)**
Railway Gazette, N° 12, March 19, p. 534.
British locomotives types — VI, London Midland & Scottish Railway. (6 figures.)

1937 **621 .132.3 (.42)**
Railway Gazette, N° 12, March 19, p. 537.
Streamlined locomotives, French State Railway (1200 words & fig.)

1937 **625 .144.1 (.42)**
Railway Gazette, N° 12, March 19, p. 539.
ALLEN (C. J.). — 120—ft. rails for the L.N.E.R. (2600 words & fig.)

1937 **625 .232 (.42)**
Railway Gazette, N° 12, March 19, p. 543.
New articulated trains for long distance excursion traffic, L.M.S.R. (1200 words & fig.)

1937 **656 .222.1 (.73)**
Railway Gazette, N° 13, March 26, p. 587.
High speed running in the United States. (2400 words & fig.)

1937 **621 .132 (.42)**
Railway Gazette, N° 13, March 26, p. 590.
British locomotives types — VII, London Midland & Scottish Railway. (8 figures.)

1937 **625 .214 (.42) & 625 .26 (.42)**
Railway Gazette, N° 13, March 26, p. 593.
White-metalling in railway shops. (1400 words & fig.)

1937 **621 .43 (.82)**
Diesel Railway Traction, p. 346, Suppl. to the Railway Gazette, February 19.
British-built railcars for South America. (1300 words & fig.)

1937 **621 .43 (.42)**

Diesel Railway Traction, p. 348, Supplt. to the Ry. Gazette, February 19.

New Great Western railcar for trailer haulage. (400 words & fig.)

1937 **385 .114 (.73) & 621 .43 (.73)**

Diesel Railway Traction, p. 349, Supplt. to the Ry. Gazette, February 19.

The design, construction and operation of a streamlined diesel train. (7 000 words & fig.)

1937 **621 .43 (.729)**

Diesel Railway Traction, p. 358, Supplt. to the Ry. Gazette, February 19.

Diesel-geared locomotive for Trinidad. (800 words & fig.)

1937 **621 .43 (.460)**

Diesel Railway Traction, p. 359, Supplt. to the Ry. Gazette, February 19.

Diesel-worked suburban traffic in Spain. (600 words & fig.)

1937 **621 .43 (.42)**

Diesel Railway Traction, p. 562, Supplt. to the Ry. Gazette, March 19.

Gardner 100 b. h. p. railcar diesel engine. (1 300 words & fig.)

1937 **621 .43 (.73) & 625 .253 (.73)**

Diesel Railway Traction, p. 565, Supplt. to the Ry. Gazette, March 19.

Braking of high-speed trains. (1 000 words.)

1937 **621 .43 (.43) & 621 .8 (.43)**

Diesel Railway Traction, p. 566, Supplt. to the Ry. Gazette, March 19.

A new gearbox development. (1 400 words & fig.)

1937 **621 .43**

Diesel Railway Traction, p. 568, Supplt. to the Ry. Gazette, March 19.

KOFFMANN (J. L.). — The standardisation of diesel railcars. (1 200 words & fig.)

1937 **621 .43 (.43)**

Diesel Railway Traction, p. 570, Supplt. to the Ry. Gazette, March 19.

Railcars on Bavarian secondary lines. (1 200 words, tables & fig.)

1937 **621 .43 (.73) & 656 .222.1 (.73)**

Diesel Railway Traction, p. 573, Supplt. to the Ry. Gazette, March 19.

Log of Denver Zephyr's record run. (200 words & fig.)

1937 **621 .331 (.485)**

Electric Railway Traction, p. 462, Supplt. to the Ry. Gazette, March 5.

OFVERHOLM (I.). — The substations of the Swedish State Railways. (800 words, tables & fig.)

1937 **621 .38**

Electric Railway Traction, p. 466, Supplt. to the Ry. Gazette, March 5.

FAIRBURN (C. E.). — Railway electrification. (2 500 words & fig.)

1937 **621 .336**

Electric Railway Traction, p. 468, Supplt. to the Ry. Gazette, March 5.

Third-rail electrification. (1 400 words.)

Railway Magazine. (London.)

1937 **656 .222.1 (.44)**

Railway Magazine, N° 477, March, p. 199.

Recent locomotive work in France. 1—Nord. (4 200 words & fig.)

1937 **656 .222.1 (.42)**

Railway Magazine, N° 478, April, p. 248.

ALLEN (C. J.). — British locomotive practice and performance. (5 500 words & fig.)

1937 **385. (091) (.485)**

Railway Magazine, N° 478, April, p. 261.

ELLIS (C. H.). — The railways of Sweden. (3 200 words & fig.) (*To be continued.*)

1937 **385. (091) (.56)**

Railway Magazine, N° 478, April, p. 279.

KATIN (L.). — Railways of the Near East. III. — The Palestine Railways. (3 600 words & fig.)

1937 **621 .13, 621 .335**

621 .43 & 656 .222.1

Railway Magazine, N° 478, April, p. 285.

Locomotive and train records. (500 words.)

Railway Mechanical Engineer. (Philadelphia.)

1937 **621 .43 (.73)**

Railway Mechanical Engineer, N° 2, February, p. 51.

Baldwin Diesel switches. (2 100 words & fig.)

1937 **313 : 625 .234 (.71 + .73)**

Railway Mechanical Engineer, N° 2, February, p. 54.

Passenger cars air-conditioned during 1936. (Tables.)

1937 **62. (01, 621 .13 & 669 .1**

Railway Mechanical Engineer, N° 2, February, p. 59.

WILLIAMS (F. H.). — Failures of locomotive parts. (Part eight of an article which began in the May, 1936, issue.) (1 700 words & fig.)

1937 **313 : 621 .43 (.71 + .73)**

Railway Mechanical Engineer, N° 2, February, p. 63.

Diesel motive power. (100 words & tables.)

1937 **656 .284 (.73)**

Railway Mechanical Engineer, N° 2, February, p. 68.

Annual report of the Bureau of Locomotive Inspection. (1 300 words & fig.)

1937 **625 .26 (.73)**

Railway Mechanical Engineer, N° 2, February, p. 77.
Sand-blasting operations at Burnside shops. (1 000 words & fig.)

1937 **625 .26 (.73) & 665 .882 (.73)**

Railway Mechanical Engineer, N° 2, February, p. 82.
Stack-cutting plate material. (3 000 words & fig.)

Railway Signaling. (Chicago.)

1937 **656 .254 (.73)**

Railway Signaling, February, p. 75.
Centralized traffic control on Texas & Pacific. (3 700 words & fig.)

1937 **656 .258 (.73)**

Railway Signaling, February, p. 79.
Automatic interlocking on Rock Island. (3 800 words & fig.)

1937 **656 .254 (.73)**

Railway Signaling, February, p. 81.
Intermittent inductive automatic train-stop test. (800 words.)

1937 **656 .284 (.73)**

Railway Signaling, February, p. 82.
Ohio-flood damages signaling. (7 000 words & fig.)

1937 **625 .162 (.73) & 656 .259 (.73)**

Railway Signaling, February, p. 88.
Electrically-locked crossing gate. (3 400 words & fig.)

1937 **656 .258 (.73)**

Railway Signaling, February, p. 91.
New-Haven consolidates three interlockings. (3 500 words & fig.)

1937 **656 .258 (.73)**

Railway Signaling, February, p. 94.
BRAINERD (H. B.). — Semi-automatic interlockings on the Boston elevated. (2 000 words & fig.)

1937 **625 .162 (.73) & 656 .259 (.73)**

Railway Signaling, February, p. 96.
BENDER (F. W.). — Cut-out control for crossing signals. (2 100 words & fig.)

South African Railways and Harbours Magazine. (Johannesburg.)

1937 **621 .33 (.68)**

South African Railways and Harbours Magazine, February, p. 145.
The Reef electrification scheme. (3 500 words & fig.)

The Locomotive. (London.)

1937 **621 .132 (.5)**

The Locomotive, N° 535, March 15, p. 66.
Three-cylinder 2-8-2 locomotives, Iranian Government Rys. (300 words.)

1937 **621 .132.8 (.73)**

The Locomotive, N° 535, March 15, p. 67.
2-6-6-4 articulated locomotives, Norfolk & Western Railway. (1 000 words & fig.)

1937 **621 .43 (.44)**

The Locomotive, N° 535, March 15, p. 69.
Diesel-electric motor coaches, Northern Railway of France. (800 words & fig.)

1937 **621 .43 (.42)**

The Locomotive, N° 535, March 15, p. 71.
New oil-engined railcar, Great Western Railway. (1 500 words & fig.)

1937 **621 .13 (.092)**

The Locomotive, N° 535, March 15, p. 73.
FELLOWS (C. R. B.). — William James, Railway Engineer. (3 200 words & fig.)

1937 **625 .25**

The Locomotive, N° 535, March 15, p. 76.
Retardation of trains. A paper by Mr. W. S. Graffius Baker, Chief Mechanical Engineer (Railways) of the London Passenger Transport Board. (2 600 words.)

1937 **621 .134.2**

The Locomotive, N° 535, March 15, p. 84.
The Baker valve gear. (1 500 words & fig.)

1937 **621 .43 (.43)**

The Locomotive, N° 535, March 15, p. 91.
Converting cars to motor units. (1 000 words & fig.)

1937 **621 .43 (.82)**

The Locomotive, N° 535, March 15, p. 92.
Diesel-mechanical rail cars, Entre Rios Railway. (1 700 words & fig.)

1937 **621 .134**

The Locomotive, N° 535, March 15, p. 94.
By-passing, collapsible piston valve rings. (700 words & fig.)

The Oil Engine. (London.)

1937 **621 .43 (.73)**

The Oil Engine, N° 47, March, p. 323.
MANN (Chas. F. A.). — Three 3.600 b. h. p. diesel locomotives. (1 300 words & fig.)

1937 **621 .43**

The Oil Engine, N° 47, March, p. 340.
Horizontal engines for railcars. (400 words & fig.)

Transit Journal. (New York.)

1937 **388 (.73) & 625 .62 (.73)**
Transit Journal, February, p. 47.
MILLER (J. A.). — What's happening to transit in Newark. — All-service vehicles are replacing street cars on eleven routes. One route has been equipped with oil-electric buses. (4 000 words & fig.)

1937 **621 .338 (.73)**
Transit Journal, February, p. 52.
Cars de luxe for the Bay Bridge. (1 600 words & fig.)

1937 **621 .338 (.73) & 625 .62 (.73)**
Transit Journal, February, p. 54.
One cent a mile... for trolley bus maintenance. (1 600 words & fig.)

1937 **625 .17 (.71 + .73)**
Transit Journal, February, p. 57.
How to keep electric track switches working in winter. (4 100 words & fig.)

1937 **625 .62 (.73)**
Transit Journal, March, p. 79.
Baltimore's streamliners 27 P.C.C. cars. (2 200 words & fig.)

In Italian.

La tecnica professionale. (Firenze.)
1937 **621 .33**
La tecnica professionale, marzo, p. 53.
Autarchia economica ed elettrificazione ferroviaria. (2 800 parole.)

L'Ingegnere. (Roma.)
1937 **624 .2**
L'Ingegnere, febbraio, p. 61.
Sul calcolo delle deformazioni delle travi. (3 000 mots, mots & fig.)

Trasporti e lavori pubblici. (Roma.)
1937 **656 (.45)**
Trasporti e lavori pubblici, gennaio, p. 3.
I problemi dei trasporti terrestri in Italia all' esame di un tecnico. (1 200 parole.)

In Dutch.

De Ingenieur. (Den Haag.)
1937 **691**
Ingenieur, Nr. 10, 5 Maart, p. Bt. 17.
FRANX (C.). — De nieuwere gezichtspunten inzake berekening van gewapend beton en onze betonschriften. (4 000 woorden & fig.)

1937

695

De Ingenieur, Nr. 12, 19 Maart, p. Mk. 11.
DANTUMA (R. S.). — De invloed van vocht op verflaklagen. (3 000 woorden & fig.)

Spoor- en Tramwegen. (Utrecht.)

1937 **385 (.494)**
Spoor- en Tramwegen, Nr. 5, 2 Maart, p. 101.
De nieuwe wet betreffende de Zwitsersche Bondsspoorwegen. (2 800 woorden.)

1937 **625 .1 (.92)**
Spoor- en Tramwegen, Nr. 6, 16 Maart, p. 115.
MEYER (H.). — De nieuwe aanleg van de Deli Spoorweg Maatschappij. (2 500 woorden & fig.)

In Polish.
(= 91.885)

Inżynier Kolejowy. (Warszawa.)

1937 **656 .215 = 91 .885**
Inżynier Kolejowy, N° 3, p. 105.
MOSKALIK (F.). — Station lighting by means of sodium vapour lamps. (2 400 words, tables & fig.)

1937 **624 .32 (.439) = 91 .885**
Inżynier Kolejowy, N° 3, p. 110.
PSZENICKI (L.). — Bridges on the Danube in Budapest. (2 200 words & fig.)

1937 **385 .57 (.438) = 91 .885**
Inżynier Kolejowy, N° 3, p. 116.
WOJCIECHOWSKI (J.). — Ten years psychotechnics on the Polish Railways. (1 200 words & fig.)

In Portuguese.

Gazeta dos Caminhos de ferro. (Lisboa.)
1937 **385 .1**
Gazeta dos caminhos de ferro, N° 1180, 16 de fevereiro, p. 101.
GALVAO (A. L.). — Caminhos de ferro que pagam. (3 300 palavras.)

In Rumanian.
(= 599)

1936 **621 .138.5 = 599**
Revista C. F. R., November-December, p. 327.
CUSUTA (St.). — A few foreign locomotive workshops. (1 100 works & fig.)

Monthly
Bulletin
of the International
Railway Congress Association
(English Edition)



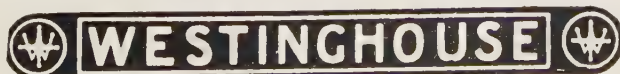
THE OLD AND THE NEW AT WATERLOO, SOUTHERN RLY



A view taken from a platform at Waterloo, Southern Railway, showing the old mechanical signalling, and, below, a similar view taken after the new electric signalling was brought into service



The new signalling on the Waterloo-Hampton Court Junction section 13½ route miles (70½ rack miles), recently brought into service, completed another stage in the Southern Railway's vast programme of modernisation. As at Charing Cross, Cannon Street, London Bridge, Brighton, and on the Brighton Line, etc :-



**SIGNAL APPARATUS
WAS USED THROUGHOUT**

**WESTINGHOUSE BRAKE & SIGNAL CO. LTD.
82, YORK ROAD, KING'S CROSS, LONDON. N. 1**

A NEW METHOD

of turning Locomotives (Patented)
**BY POWER FROM THE
 BRAKE SYSTEM**



L. M. S. Turbine Locomotive on one of our Non-Balanced Turntables fitted with our Patent Vacuum Engine



L. N. E. R. Locomotive being turned on an existing Balanced Turntable fitted with our Patent Vacuum Engine Tractor

BALANCED AND ARTICULATED TURNTABLES
 WATER COLUMNS AND WHEEL DROPS
 RAILWAY BREAKDOWN CRANES
 with and without patent relieving bogies
 DOCK CRANES AND CAPSTANS
 of every description
 OVERHEAD CRANES

COWANS, SHELDON & CO L^{TD}

London Office:
 BUSH HOUSE ALDWYCH W. C. 2
 Telephone: Temple Bar 7851

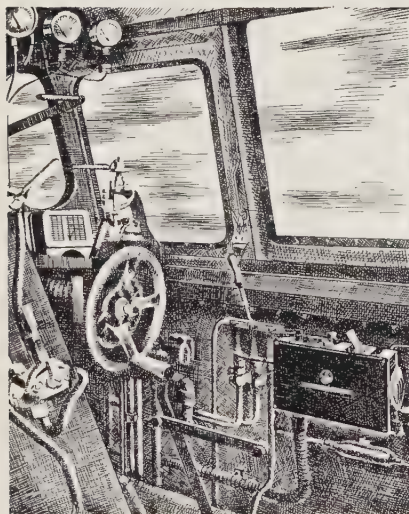
ST. NICHOLAS WORKS, CARLISLE

TELEPHONE: CARLISLE 13

Automatic Train Control

train speed 200 km/h

(INDUCTIVE SYSTEM)

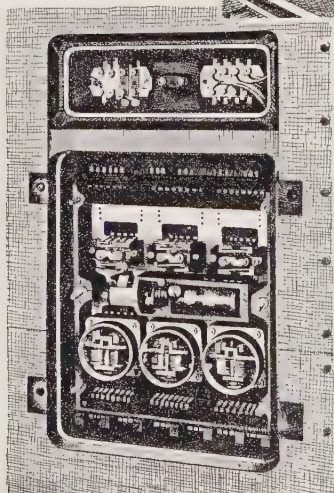


Recording tachometer and brake device in the cab of a streamlined locomotive of the German State Railways.



One of the founder firms of the « Vereinigte Eisenbahn-Signalwerke » was the first German factory to design automatic train control apparatus. The VES automatic train control system is based on 30 years research work and has proved its efficiency and reliability for the highest train speeds obtained up to now. On a test run, a streamlined steam locomotive of the German State Railways, equipped with automatic train control apparatus, reached a speed of 201 km/h.

Apparatus case and locomotive magnet.



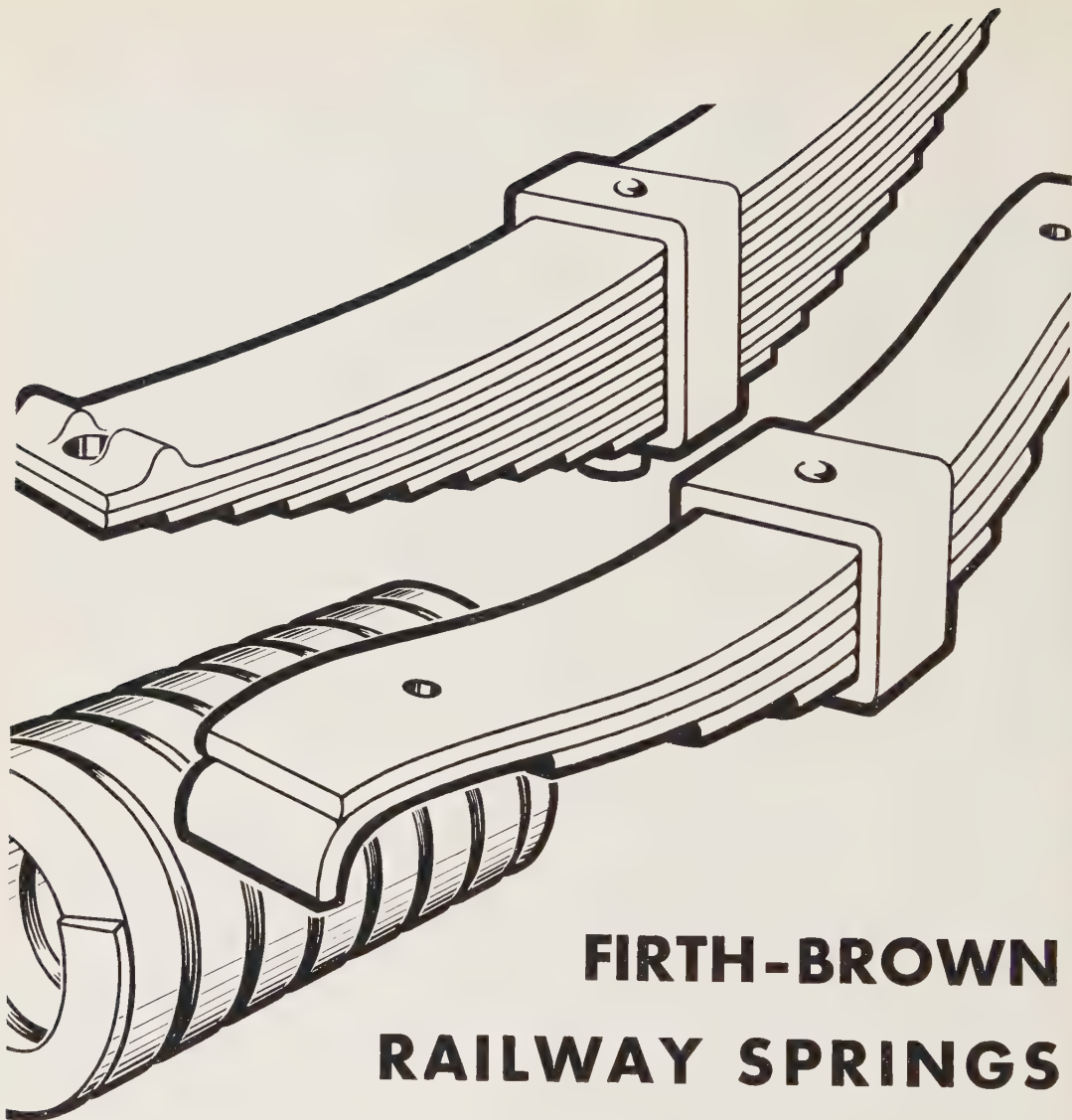
Apparatus case, open.



VEREINIGTE EISENBAHN - SIGNALWERKE

G. M. B. H.

BERLIN - SIEMENSSTADT



FIRTH-BROWN RAILWAY SPRINGS



Specialising in the production of wagon, carriage and loco springs, this company places at the disposal of Railway authorities an unusually wide experience of spring problems, unsurpassed facilities for research and rapid, accurate production resources. This service is keyed up to one ideal — that of meriting continued confidence.

THE FIRTH & JOHN BROWN LTD SHEFFIELD

'ENGLISH ELECTRIC'



**Complete Railway
Electrification
Schemes
Undertaken in any
part of the World**

Manufacturers of :

ELECTRIC
LOCOMOTIVES

DIESEL ELECTRIC
LOCOMOTIVES

DIESEL MECHANICAL
LOCOMOTIVES

MOTOR COACH STOCK
WITH ELECTRIC OR
DIESEL PROPULSION

BATTERY
LOCOMOTIVES



DIESEL LOCOMOTIVES

FOR ALL CLASSES OF DUTY

The illustrations show one of the 'English Electric-Hawthorn Leslie' Diesel Locomotives which are now operating on the Sudan Government Railways. Features of particular interest, in view of the arduous operating conditions and the dust storms which are experienced, are the special air filtering equipment which is fitted to the main engines, and the electric transmission.



THE ENGLISH ELECTRIC COMPANY LIMITED

QUEEN'S HOUSE, KINGSWAY, LONDON W.C. 2

WORKS: STAFFORD · BRADFORD · RUGBY · PRESTON

BRANCH OFFICES AND ASSOCIATES ABROAD :

ARGENTINA, AUSTRALIA, BRAZIL, CANADA, CEYLON, CHILE, CHINA, DENMARK, EGYPT, ICELAND, INDIA, JAPAN, MALAYA, NEW ZEALAND, RHODESIA, SOUTH AFRICA, WEST INDIES, YUGO-SLAVIA.



MODERN TRAFFIC REQUIRES MODERN TRACK

PERFECT SECURITY

for heavy traffic
and high speeds

no bolts • no loosening
no up-keep
an always accurate gauge

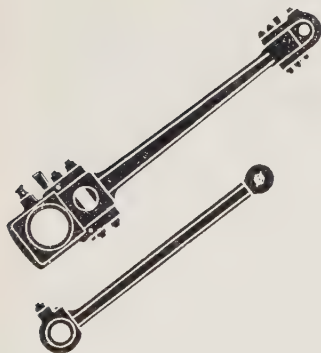
THE STEEL SLEEPER

SALES MONOPOLY: SOCIÉTÉ COMMERCIALE D'OUGRÉE AT OUGRÉE
OUGRÉE-MARIHAYE PATENT

THE APPLICATION OF ALLOY AND SPECIAL STEELS TO RAILWAY ENGINEERING



Coupling & Connecting Rods



Increase in the speed of locomotives for both freight and passenger service has made the effective balancing of reciprocating parts more necessary, and at the same time more difficult. As the out-of-balance forces are proportional to MV^2 , increase in speed can only be counteracted by reducing the weight of the parts in question.

Reduction in weight can be achieved by the use of steels with higher tensile and fatigue strengths. These characteristics can be attained without loss of ductility by the use of suitable alloy steels which have, in addition, a relatively high yield ratio. This is advantageous in resisting distortion due to the suddenly applied overloads which frequently occur in service.

Our experience over a number of years leads us to put forward the following steels for Locomotive Coupling and Connecting Rods:

"TORMANC SPECIAL"

—A Low Carbon Manganese Molybdenum Steel.

This steel, normalised and tempered, gives a tensile strength of 38.45 tons, and oil hardened and tempered, a tensile of 40.47 tons. It is simple to manipulate and to heat treat, and is particularly proof against abuse in the treatment process. For these reasons it is of particular interest to railway workshops without previous experience in handling alloy steels.

"TORMOL"—Nickel Chrome Molybdenum Oil Hardening Steel.

"Tormol" steel represents the highest grade of Nickel Chrome Molybdenum Steel available to the engineer. It is used in the oil hardened and tempered condition at a tensile of 55.65 tons. It requires rather more care in forging and treatment than "Tormanc Special," and for this reason we are frequently called upon to supply in the form of rough machined and heat treated forgings.

Both these steels have been thoroughly proved in service. If you are interested please write for further data which we have available.

THE UNITED
STEEL
COMPANIES LTD

SAMUEL FOX & COMPANY LIMITED
Associated with The United Steel Companies Limited
STOCKSBRIDGE **SHEFFIELD, ENGLAND**

High Pressure Steam

-and the Lubrication Problem



THE L.N.E.R. 4- CYLINDER COMPOUND EXPRESS LOCOMOTIVE depicted above, fitted with high pressure Yarrow-Gresley boiler, is equipped with WAKEFIELD No 7 pattern Mechanical Lubricators for valves, cylinders and axleboxes. One of the principal and most difficult problems associated with the use of steam at very high pressures in locomotives is that of lubricating the cylinders and piston valves; whilst for heavily loaded bearings forced lubrication has become a necessity. WAKEFIELD'S Mechanical Lubricators adequately meet both requirements.

C. C. WAKEFIELD & CO., LTD.
WAKEFIELD HOUSE, 30-32, CHEAPSIDE, LONDON, E. C. 2



L.N.E.R. SETS A *new* STYLE FOR WAITING ROOM DECORATION

Delightful effect has been achieved by the skilful use of "Rexine" for the dados, walls and ceilings of Shenfield Station waiting room, illustrated here. Beauty and utility in modern decoration finds full expression in "Rexine," for "Rexine" is not only pleasing in appearance, but is scratchproof, stainproof and extremely hard wearing. For public rooms and offices "Rexine" is the ideal decorative material because it requires little or no maintenance, is easy to clean and therefore hygienic.

SPECIFY

"Rexine"
BRAND

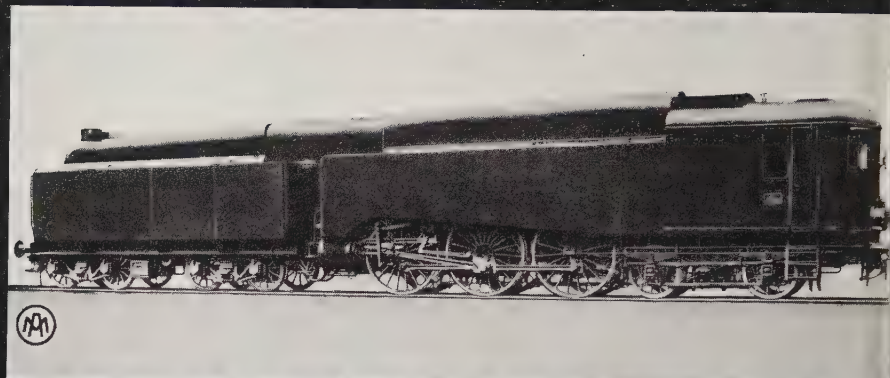
PANELLING CLOTHS

FOR INTERIOR DECORATION

I.C.I. (REXINE) LTD., HYDE, CHESHIRE
I.C.I. (Rexine) Ltd. is a subsidiary company of Imperial Chemical Industries Ltd.
London Office: 60 Wilson Street, Finsbury, E.C.2

R.A.540

"FRANCO"
double-unit
LOCOMOTIVE



"FRANCO,"
triple-unit
LOCOMOTIVE



BRUSSELS-
ANTWERP
ELECTRIC TRAIN



LES ATELIERS METALLURGIQUES
NIVELLES
BELGIQUE

VICKERS "V.I."

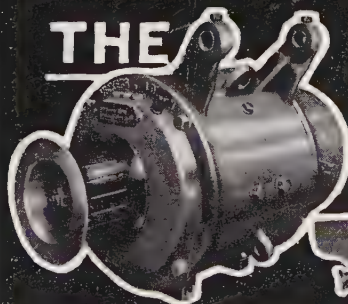
SINGLE BATTERY SYSTEM

for ELECTRIC LIGHTING

OF TRAINS.

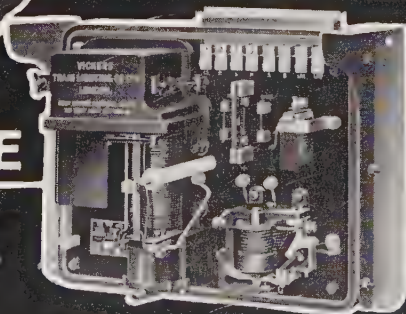


THE



DOES THE WORK

AND THE



CONTROLS
THE LIGHT

CALL AND SEE IT IN OPERATION IN OUR SHOWROOM
VICKERS TRAIN LIGHTING CO LTD

(Proprietors: VICKERS LIMITED)

VICKERS HOUSE, BROADWAY, LONDON, S.W.1.

Telegrams: VICTRALITE, SOWEST, LONDON. Cablegrams: VICTRALITE, LONDON. Telephone: VICTORIA. 6900.



NEW « TOURIST » ARTICULATED COACHES

BUILT FOR THE
**LONDON & NORTH
EASTERN RAILWAY**

By the Metropolitan - Cammell
Carriage, Wagon & Finance
Co. Limited, to the designs of
Mr. H. N. Gresley, C.B.E., Chief
Mechanical Engineer.



METROPOLITAN-CAMMELL

CARRIAGE WAGON & FINANCE CO LIMITED

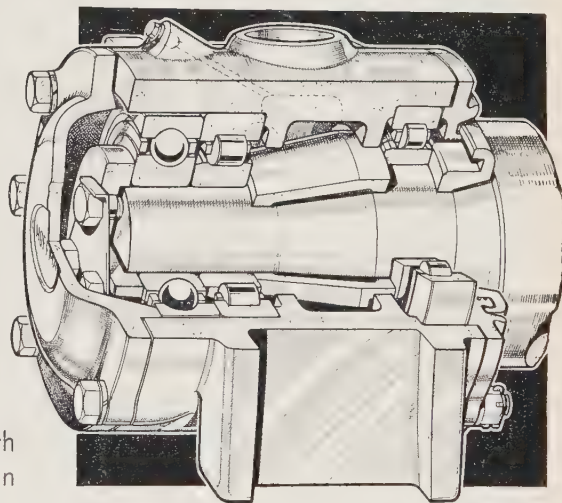
Head Office: SALFORD, BIRMINGHAM

London Office: 101 MARK LANE, LONDON, E.C.3



ROLLER BEARING AXLE BOXES

Servicing troubles cease
with the adoption of



Hot Boxes. These are unheard of with Hoffmann Roller Bearings. The secret lies in their low co-efficient of friction.

Lubrication. This is needed only 3 or 4 times a year and can hardly be termed "a trouble" when compared with the frequency with which plain bearing boxes must be lubricated.

Renewals. These are not required, because Hoffmann Roller Bearings are, practically speaking, wearless.

Other adaptations of this box can be supplied to meet special conditions.

Simplicity of design allows of easy mounting and dismantling, a feature of special appeal.

From this drawing it can be seen that the box with the complete location bearing and the outer races and rollers of the roller bearings are withdrawable, simply by removing the end cover and clamping plate. Remounting is just as easy.

**The experience of our Technical Staff
is freely at your disposal**

THE HOFFMANN MFG. CO. LTD.
CHELMSFORD, ESSEX.

SOUTHERN RAILWAY · METRO-
 POLITAN RAILWAY ("LONDON
 TRANSPORT")
 UNDERGROUND ELECTRIC RLY.
 ("LONDON
 TRANSPORT") · SOUTH AFRICAN
 RLYS. · SYDNEY SUBURBAN RLY.
 CENTRAL RAILWAY OF BRAZIL
 NORTE DE AGOSTO RLY. OF SPAIN
 CZECHOSLOVAK STATE
 POLISH RLYS. · BUENOS
 AIRES V. R. · CENTRAL
 ARGENTINE RLYS.
 PAULISTA RLY. · SEY RLY.
 L. M. & S. RLY. · N. E. RLY.
 GREAT INDIAN PENINSULA RLY.
 HUNGARIAN RAILWAYS
 OESTE RAILWAY
 JAPANESE GOVERNMENT RLYS.
 MOSCOW RAILWAY



METROPOLITAN
Vickers

ELECTRICAL CO., LTD.
 TRAFFORD PARK · MANCHESTER 17.

Globe reproduced by
 courtesy of Messrs
 George Philip
 & Son Ltd.



SOLID FORGED AND ROLLED STEEL WHEELS

TYRES, AXLES
& DISC CENTRES

FOR
LOCOMOTIVES
CARRIAGES & WAGONS



TAYLOR BROS

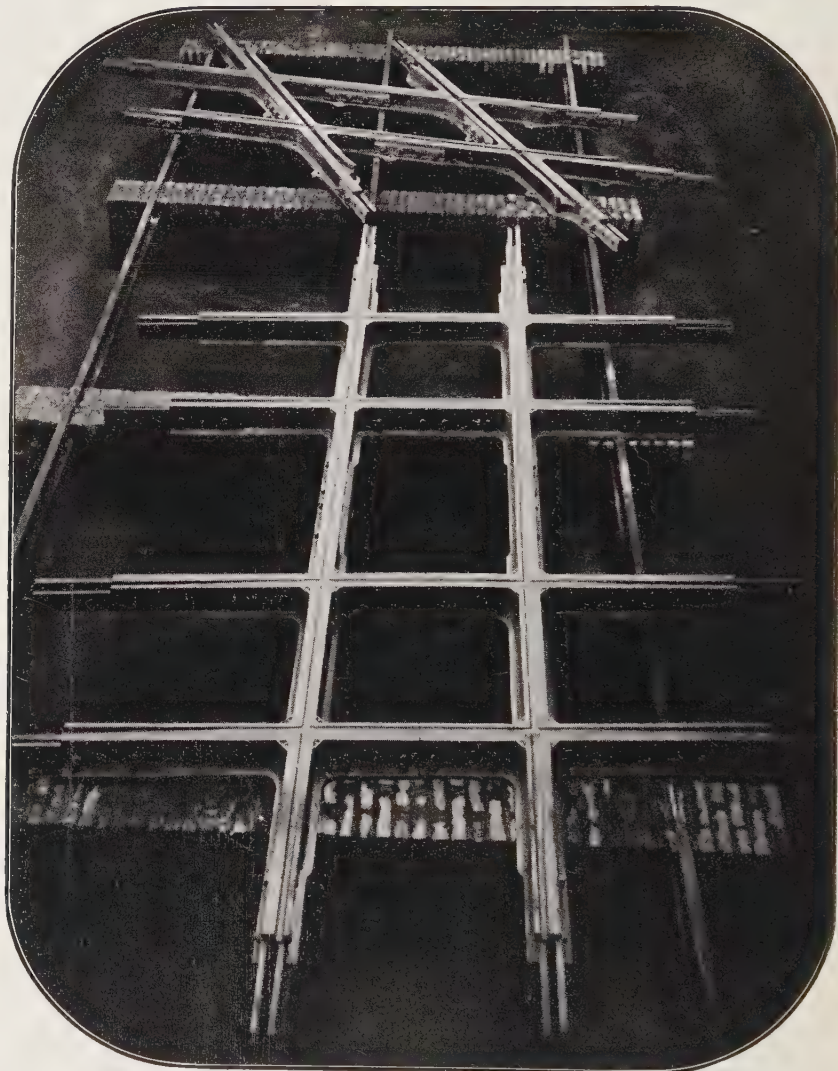
& COMPANY LIMITED

TRAFFORD PARK STEEL WORKS, MANCHESTER.

London Office:
VICKERS HOUSE, BROADWAY,
WESTMINSTER, ——— S.W. 1.

John Cockerill & C^o

SERAING
(Belgium)



**Railway cross-
ing of man-
ganese steel**

Mines, Iron & Steel Works
Engineering, Shipbuilding
Artillery, Cement

ALL RAILWAY ENGINEERS

should obtain particulars

of A.E.C. oil engined Rail-

cars. These modern units,

so extensively operated

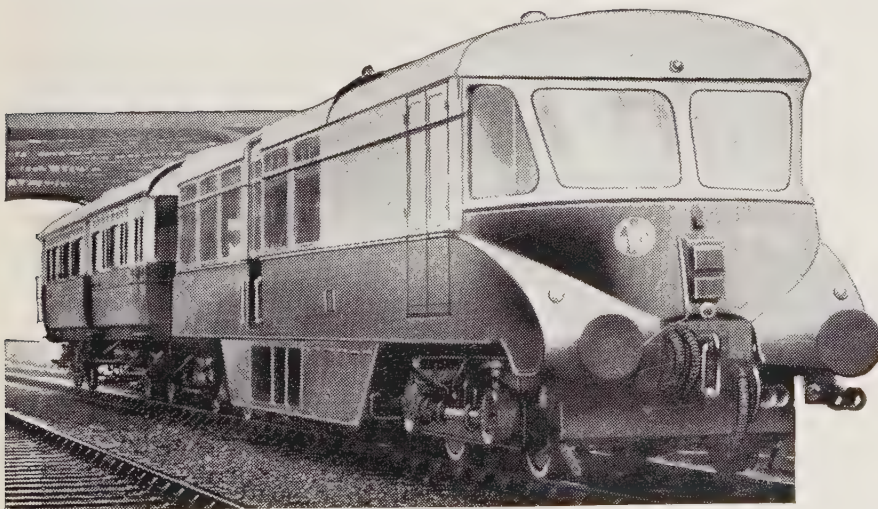
by the G.W.R., warrant

the fullest investigation.



RAILCARS

LITERATURE ON REQUEST



The Associated Equipment Co. Ltd., Southall, Mdx., Eng.

BUILDERS OF LONDON'S BUSES AND TROLLEY BUSES



AIR CONDITIONING EQUIPMENTS

NEW AND ^{for} EXISTING
RAILWAY STOCK
BROAD OR NARROW GAUGE
IN ANY PART OF THE
WORLD

The manufacture by J. Stone & Company of Railway Carriage Air Conditioning Equipments, is a logical development arising out of their extensive experience in the manufacture of axle-driven electrical equipment for Railway Rolling Stock — for Lighting, Cooking, Heating, Ventilation and Refrigeration.

They have made a very special study of the application of Air Conditioning to railway vehicles and their equipments are giving satisfactory service in various parts of the world.



J. STONE & CO. LTD.

• DEPTFORD • LONDON • ENGLAND •

TURTON BROTHERS & MATTHEWS, LIMITED.

SHEFFIELD



SOLE-MAKERS OF THE

TIMMIS' DOUBLE - WEB

High-class steel springs for all purposes

The « PILOT BRAND » springs are made only of the highest quality of material. The greatest skill is used in their manufacture. They are finished with the greatest accuracy. They are made in SHEFFIELD.

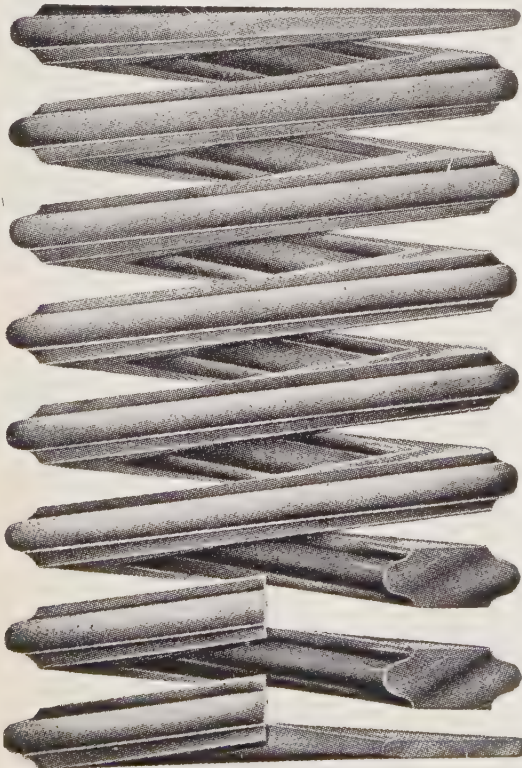
They will outlast any other springs as has been proved by over 50 years of experience.

Instances have been brought to our notice of springs being in service for over 30 years, and even then some were unbroken.

These springs are, therefore, suitable for Railway Rolling Stock where a very high standard is insisted on. They are especially suitable for Carriage Bolster Bearing Springs where ease and steadiness in running as well as reliability are essential.

They are in use on the LONDON & NORTH EASTERN RAILWAY, LONDON MIDLAND & SCOTTISH RAILWAY and SOUTHERN RAILWAY and many other Railways.

The famous Silver Jubilee Train of the L. & N. E. R. is fitted throughout with these springs.



FOR TRAIN LIGHTING

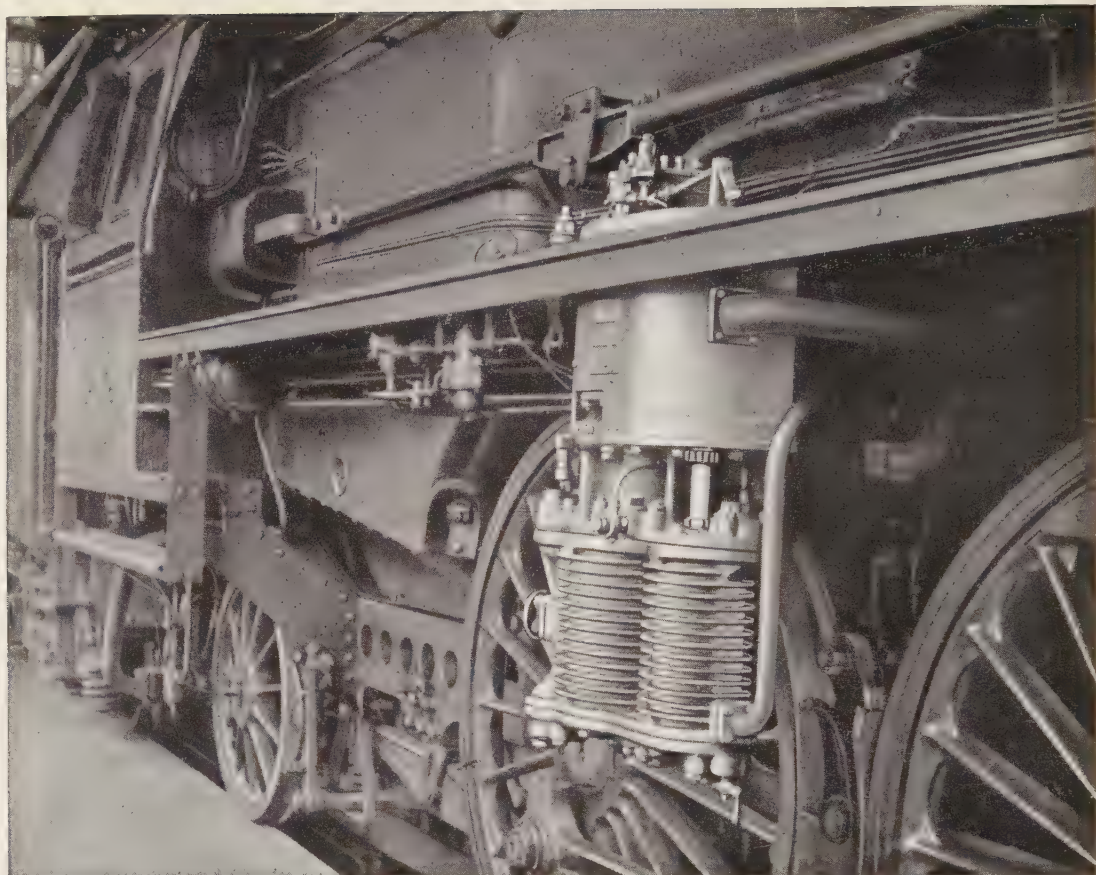
P & G AND E. P. S CELLS

PRITCHETT & GOLD AND E.P.S. CO., LTD.
50, GROSVENOR GARDENS, LONDON, S.W.1.

Telephone: Sloane 7164.

Telegrams: Storage Sowest, London.

Works: Dagenham Dock, Essex.



Knorr's Cross-Compound Air Compressors

Air brakes need reliable air supply. The cross-compound air compressor with steering mechanism type Nielebock (patented) has proved its value many thousand times.

The advantages are: troublefree working — smooth and noiseless running — high performance with little steam consumption and high volumetric efficiency — compact design and small weight.

The air compressor delivers 106 cu. ft. per minute of air sucked-in against pressures up to 147 lbs. per sq. inch. Economically lubricated by a pump working in accordance with the number of piston strokes. Easily interchangeable and automatically adjustable metal stuffing boxes for piston rods in steam- and air portion. Handy located and massless air valves.

A governor cuts out the compressor as soon as working pressure is reached in main reservoir, and cuts in on the slightest drop in reservoir pressure.



KNORR-BREMSE
A-G **BERLIN O 112**

Bulletin of the International Railway Congress Association

CONTENTS OF THE NUMBER FOR JUNE 1937.

- 1937 625 .14
Bull. of the Int. Ry. Congress Ass^{on}, No. 6, June, p. 1487.
FLAMENT (H.). — The construction of modern track to carry heavy loads at high speeds and methods of modernising old track for such loads and speeds. Facing points that can be taken at high speeds (Subject I, 13th Congress). Special account summing up the reports published on this question. (4 000 words.)
- 1937 621 .392 & 625 .143
Bull. of the Int. Ry. Congress Ass^{on}, No. 6, June, p. 1494.
MÜLLER (Dr.-Ing.). — Use of welding: (1) to obtain extra-long rails; (2) in manufacturing and repairing points and crossings (Subject II, 13th Congress). Special account summing up the reports published on this question. (7 000 words.)
- 1937 625 .17
Bull. of the Int. Ry. Congress Ass^{on}, No. 6, June, p. 1505.
MUNDT (Th. W.). — Methodical and periodical maintenance of: (1) metal bridges; (2) signals; (3) metal supports carrying the contact wire on electric railways. — Organisation, working methods, materials used (Subject III, 13th Congress). Special account summing up the reports published on this question. (4 800 words.)
- 1937 621 .43
Bull. of the Int. Ry. Congress Ass^{on}, No. 6, June, p. 1513.
DUMAS (L.). — Evolution of the rail motor car as regards its construction, and special investigation into the transmission and brake questions. Comparative methods of testing railcars. Detailed investigation into the costs of railcars and the methods of reducing them (Subject IV, 13th Congress). Special account summing up the reports published on this question. (5 300 words.)
- 1937 621 .13
Bull. of the Int. Ry. Congress Ass^{on}, No. 6, June, p. 1521.
GRESLEY (Sir H. Nigel). — Recent improvements in steam locomotives of the usual type and tests of new designs (high pressure reciprocating locomotives and turbine locomotives) as regards construction, quality of materials used, efficiency, working conditions, maintenance and financial results. — Testing locomotives at experimental stations, and in service with dynamometer cars and brake locomotives (Subject V, 13th Congress). Special account summing up the reports published on this question. (4 500 words.)
- 1937 621 .33
Bull. of the Int. Ry. Congress Ass^{on}, No. 6, June, p. 1528.
FAIRBURN (C. E.). — Methods and devices used, in connection with electric traction, to save current between the supply side of the power station and the driving wheels (feeders substations, tractors), and in particular the use of mercury rectifiers (Subject VI, 13th Congress). Special account summing up the reports published on this question. (6 400 words.)
- 1937 656 .27
Bull. of the Int. Ry. Congress Ass^{on}, No. 6, June, p. 1538.
PALMIERI (G. C.). — Economical operation of the main-line systems' secondary lines (Subject VII, 13th Congress). Special account summing up the reports published on this question. (6 200 words.)
- 1937 656 .212.5 & 656 .225
Bull. of the Int. Ry. Congress Ass^{on}, No. 6, June, p. 1548.
BAUMANN (Dr.-Ing. A.). — Application of rational organisation (planning) to the transport of goods (Subject VIII, 13th Congress). Special account summing up the reports published on this question. (9 000 words.)
- 1937 656 .254
Bull. of the Int. Ry. Congress Ass^{on}, No. 6, June, p. 1562.
TUJA (J.) and LEMONNIER (A.). — Results obtained from the automatic and distant operation of signals and points, and from locomotive cab signals (Subject IX, 13th Congress). Special account summing up the reports published on this question. (5 500 words.)
- 1937 656
Bull. of the Int. Ry. Congress Ass^{on}, No. 6, June, p. 1571.
COTTIER (Dr.). — Effects of the world crisis and road competition on the railway position. Corresponding changes in railway commercial policy (Subject X, 13th Congress). Special account summing up the reports published on this question. (11 000 words.)
- 1937 385 .57
Bull. of the Int. Ry. Congress Ass^{on}, No. 6, June, p. 1588.
WOJCIECHOWSKI (J.). — Selection, orientation and instruction of railway staff (Subject XI, 13th Congress). Special account summing up the reports published on this question. (4 200 words.)
- 1937 625 .611 & 656 .27
Bull. of the Int. Ry. Congress Ass^{on}, No. 6, June, p. 1595.
BELMONTE (L.). — Co-ordination of operation as between main-line and light railways (Subject XII, 13th Congress). Special account summing up the reports published on this question. (3 800 words.)
- 1937 625 .61 (01
Bull. of the Int. Ry. Congress Ass^{on}, No. 6, June, p. 1601.
SVOBODA (A.). — Specifications for the fixed plant of railways with light traffic, intended to prevent the use of unnecessarily expensive track equipment, and generally to give economical working (Subject XIII, 13th Congress). Special account summing up the reports published on this question. (3 000 words.)

Alphabetical Index of Advertisers

Firms:

Albion Motor Car Co.
 Anglo-Franco-Belge, S. A.
 Anti-Attrition Metal Co. (The)
 Armstrong Oiler Co., Ltd. (The)
 Associated Equipment Co., Ltd. (The)
 Ateliers de Constructions Electriques de
 Charleroi
 Ateliers de Construction de la Meuse
 Ateliers Gamain
 Ateliers Métallurgiques
 Auxiliaire des chemins de fer et de
 l'Industrie
 Baume et Marpent
 Bayliss, Jones & Bayliss, Ltd.
 Beardmore & Co., Ltd. (Wm.)
 Birmingham Ry. Carriage & Wagon Co.,
 Ltd. (The)
 Bobby, William & Co., Ltd.
 Bonnel (1924), Ltd. (W. A.)
 British Aluminium
 Brugeoise et Nicaise & Delcuve (La)
 Chloride Electrical Storage Co., Ltd. (The)
 Cockerill & Co. (John)
 Coltness Iron Co., Ltd.
 Colvilles, Ltd.
 Cowans, Sheldon & Co., Ltd.
 Crompton Parkinson, Ltd.
 Davies & Metcalfe, Ltd.
 Demag, A. G.
 Deutsche Getriebe
 Docker Brothers
 Dunlop Rubber Co., Ltd.
 English Electric Company, Ltd. (The)
 English Steel Corporation, Ltd.
 Firth (Thos) & Brown (John), Ltd.
 General Electric Co., Ltd.
 Gresham & Craven, Ltd.
 Guest, Keen & Nettlefolds, Ltd.
 Haine-St-Pierre (Forges, Usines et Fon-
 deries de)
 Henricot Steel Foundry (The)
 Hoffmann Mfg. Co., Ltd. (The)
 Kaye & Sons, Ltd. (Joseph)
 Kearns & Co., Ltd. (H. W.)
 Knorr-Bremse, A. G.
 Laycock Engineering Co., Ltd. (The)
 Lightalloys, Ltd.
 London & North Eastern Ry.
 Maschinenfabrik Augsburg-Nürnberg A.G.
 Metropolitan Cammel Carriage Wagon
 & Finance Co., Ltd.
 Metropolitan Vickers Electrical Co., Ltd.
 Monk Bridge Iron & Steel Co., Ltd. .

Specialities:

— Commercial and public service motor vehicles.
 — Locomotives and Railway rolling stock.
 — Bronzes and white bronzes for railway purposes.
 XXIX Lubricators.
 XVIII Passenger and commercial motor vehicles.
 — Electric train lighting. Electric signalling.
 — Locomotives.
 — Precision mechanics.
 XI Locomotives, Railway and Tramway rolling stock.
 — Preheaters, Purifiers, De-aerators.
 — Railway and Tramway rolling stock.
 — Railway fastenings, rail screws, etc.
 — Diesel motor coaches, etc.
 — Railway rolling stock.
 — Water softeners for Railways.
 — Cemented waterproof. Sleepers, crossings, etc.
 — Aluminium alloy.
 — Railway rolling stock and fixed equipment.
 — Train lighting batteries.
 XVII Iron and steel in all forms.
 XXIX Locomotive steel castings.
 — Boiler plates.
 III Vacuum power locomotive turning gear.
 — Traction equipment.
 — Injectors, ejectors, etc.
 — Special Cranes and Lifting Appliances.
 — Mylius transmission for Railcars.
 XXVIII Varnishes, Japans, Fine colours, etc.
 — Rubber springs, Buffers, Hosepipes.
 VI Railway electrification.
 — Alloy steels.
 V Hollow forgings. Tyres, axles, etc.
 — Mercury arc rectifiers.
 — Ejectors, injectors, lubricators, etc.
 XXV Screws.
 — Railway rolling stock.
 XXVI Steel Castings for Railways.
 XIV Bearings.
 XXVII Seamless steel oil feeders.
 — Borers.
 XXI Air brakes, feedwater heaters, etc.
 — Railway specialities of all kinds.
 XXVII Aluminium alloys in all forms.
 — Public Transport.
 — Diesel and Electric Railcars.
 XIII Rolling stock of all kinds.
 XV Railway Electrification.
 — Locomotive forgings, tyres, axles, etc.

Firms:

Murex Welding Processes Ltd.
 Nobel Chemical Finishes Ltd.
 Pritchett & Gold and E. P. S., Ltd.
 Rexine, Ltd.
 Roberts (J. W.), Ltd.
 « Sentinel » Waggon Works, Ltd. (The).
 Siemens-Schuckertwerke
 Société Commerciale d'Ougrée
 Spencer (J.) & Sons, Ltd.
 Spencer-Moulton & Co., Ltd. (George) .
 Still & Sons, Ltd. (W. M.)
 J. Stone & Co., Ltd.
 Superheater Company (The), London . .

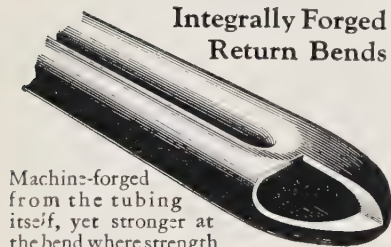
Superheater Company (The), New York.
 Talbot
 Taylor Bros & Co., Ltd.
 Turton Brothers & Matthews, Ltd. . . .
 United Steel Companies, Ltd. (The) . .
 Vacuum Brake Co., Ltd.
 Vacuum Oil Company, Ltd.
 Vereinigte Eisenbahn-Signalwerke . . .
 Vereinigte Westdeutsche Waggonfabriken
 Vickers Train Lighting Co., Ltd. . . .
 Vi-Spring Products, Ltd.
 Wakefield & Co., Ltd.
 Ward & Ltd.
 Westinghouse Brake & Signal Co., Ltd.
 Wild & Co. (A. G.)
 Willford and Company, Ltd.

Specialities:

- Welding Processes.
- XXVI « Dulux » coach finishes.
- XX Accumulators for train lighting.
- X Leathercloths.
- Asbestos products in all forms.
- Locomotives. Rail cars, etc.
- Electric Equipments.
- VII Patented steel sleepers.
- Railway springs, axle forgings, etc.
- XXXI India rubber springs of all kinds.
- Kitchen and service equipment.
- XIX Railway specialities of all kinds.
- Superheaters for locomotives and multiple valve regulator headers.
- XXIV Steam superheaters for locomotives, marine, etc.
- Ballasting Wagons.
- XVI Wheels and axles.
- XX Timmis Double-Web spiral steel springs.
- VIII Steel sleepers, steel for all purposes.
- Air brakes.
- Lubricants for locomotives.
- IV Railway signalling.
- Rolling stock.
- XII Train lighting dynamos and equipment.
- Seat springs.
- IX Mechanical lubricators: oils for all purposes.
- XXVIII Machine Tools.
- II Railway signalling. Brakes. Heating systems.
- Railway supplies, steam heating, etc.
- XXV Railway springs and for all their purposes.

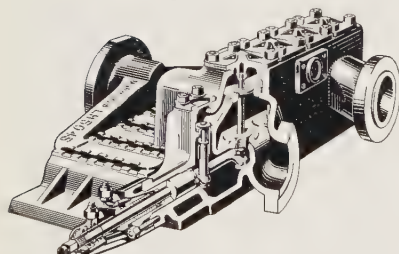
Serving the SUPERHEATING REQUIREMENTS of the WORLD'S RAILWAYS

**Integrally Forged
Return Bends**



Machine-forged from the tubing itself, yet stronger at the bend where strength is most needed. Provides constant area through the bend, with smooth internal and external surfaces—avoiding restriction of steam through units or accumulation of soot, ashes or cinders.

**Multiple-valve
Throttle-headers**



A finger-type header with multiple-valve throttle or regulator contained in the casting. Without changing smokebox arrangement this throttle-header offers distinct advantages: Steam is controlled between the superheater and cylinders; superheated steam is always available for auxiliaries; use of a series of small valves opening and closing consecutively gives better and quicker control of locomotive movements.

Through a coordinated service with associated organizations in Great Britain, France, Germany, the United States, Canada, and Australia, the railways of the world are served with locomotive superheating equipment, that conforms to a general standard of practice, yet is adapted to the particular requirements of each individual country.

A distinguishing characteristic of the locomotive superheaters manufactured by these associated companies is the exclusive use of return bends, integrally forged with the tubing to form the loops of the superheater elements or units. These bends are machine-forged without utilizing either additional material or a flux. Railroads the world over have standardized on locomotive superheaters with these integrally-forged return bends. They have been applied to more than 100,000 locomotives.

These associated companies, as a result of constant development and research, and interchange of combined experience in modern railroading, offer improved superheating equipment to meet the changing conditions of locomotive operation. An outstanding recent development, now being adopted rapidly for every class of locomotive service, is the multiple-valve throttle-header.

THE SUPERHEATER COMPANY

60 East 42nd Street, New York, N. Y., U. S. A.

ASSOCIATED COMPANIES:

The Superheater Company, Limited
Dominion Square Bldg., Montreal, CANADA

Compagnie des Surchauffeurs
Rue la Boétie 3, Paris, FRANCE



The Superheater Company Limited
Bush House, Aldwych, London, W. C. 2, ENGLAND

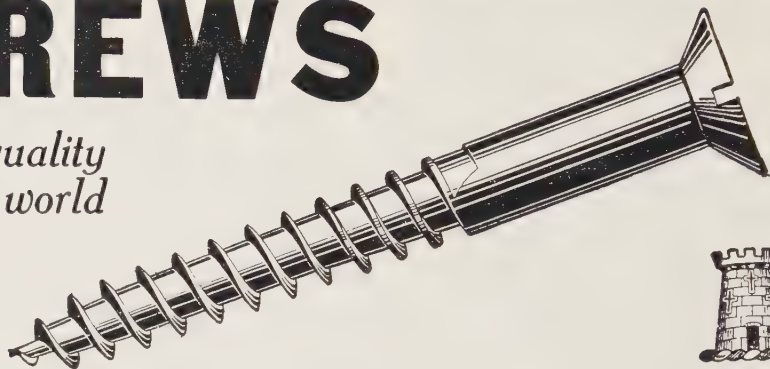
Schmidt'sche Heissdampf-Gesellschaft, m. b. H.,
Rolandstrasse 2, Cassel-Wilhelmshöhe, GERMANY

The Superheater Company (Australia) Limited
Manchester Unity Building, 185 Elizabeth Street, Sydney, N. S. W.

Agencies Throughout the World

NETTLEFOLDS SCREWS

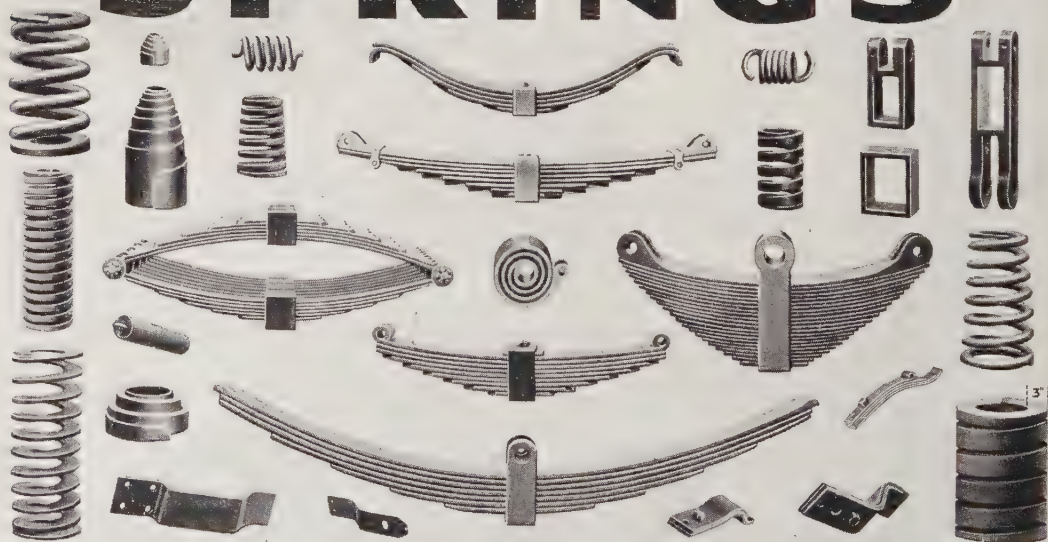
*Standard quality
all over the world*



TRADE MARK

GUEST, KEEN & NETTLEFOLDS, LIMITED,
BIRMINGHAM -- ENGLAND

SPRINGS



WILLFORD & COMPANY LIMITED,

ESTABLISHED 1890

LONDON OFFICE:

34, Victoria Street,

Westminster, S.W.1.

PARK HOUSE WORKS, SHEFFIELD.

Telephone: 21114 SHEFFIELD.

Telegrams: "AUDAX, PHONE, SHEFFIELD."

Code: BENTLEYS.

ALSO AT

BURNBANK WORKS,
DENNISTOUN, GLASGOW.

CONTRACTORS TO THE LEADING BRITISH, INDIAN, SOUTH AMERICAN AND COLONIAL RAILWAYS.
MODERN PLANT, SERVICES OF FIRST CLASS DESIGNING STAFF AVAILABLE.

DULUX RESISTS *Scratches* TOO...

it will not mark easily because it is tough and stands up to rough treatment. 'Dulux' Coach Finishes have remarkable resistance to hard wear and tear, and have proved economical in service. They reduce maintenance costs.

Write for technical literature and colour cards which will give further particulars.

DULUX TRADE MARK **COACH FINISHES**

● NOBEL CHEMICAL FINISHES LIMITED

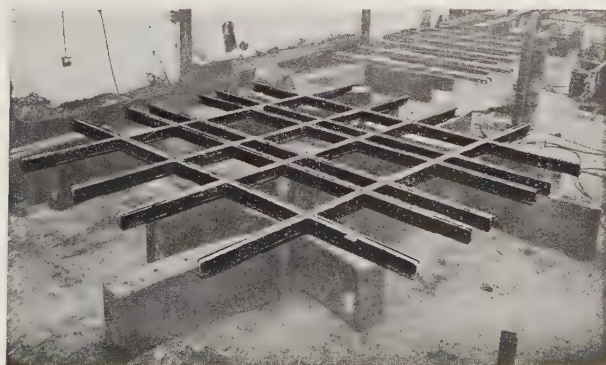
(Associated with Imperial Chemical Industries Limited)

NOBEL HOUSE, BUCKINGHAM GATE, LONDON, S.W.1



D.I.383

STEEL **CASTINGS** FOR RAILWAYS



SIDEFRAMES
with integral boxes
ROLLER BEARING
JOURNAL BOXES

"MONOBLOC" CASTINGS
for passenger stock

LOCOMOTIVE CASTINGS

POINTS & CROSSINGS

AUTOMATIC COUPLERS &
MINER DRAFT GEAR

SPECIAL STEEL
FORGINGS & BARS

STAINLESS STEEL

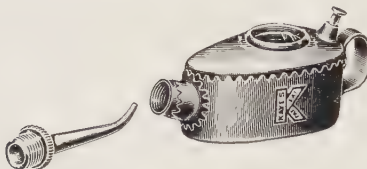
TOOL STEEL

The HENRICOT STEEL FOUNDRY

5, LAURENCE POUNTNEY HILL, CANNON STREET, LONDON - WORKS AT COURT-S'-ETIENNE (BELGIUM)

Kaye's patent automatic wedge locks cabinet locks etc., fitted throughout on the new high speed trains put in service on the L. & N. E. Railway.

Also makers of Kaye's patent seamless steel oil feeders torch lamps, etc.



JOSEPH KAYE & SONS LTD.

Lock Works, Leeds 10 & 93, High Holborn, London W.C.1.

Established 1864

ALPAX

MODIFIED ALUMINIUM



TRADE MARK
SILICON ALLOY

TRACTION MOTOR GEAR CASES

PATENT NO.
407,432



ALPAX WORKS
ST. LEONARDS ROAD,
WILLESDEN JUNCTION LONDON N.W.10
Telephone: Willesden 3460-1-2
Telegrams: Lytalloys Phone London

LIGHTALLOYS LIMITED

Ward

CAPSTAN & TURRET LATHES

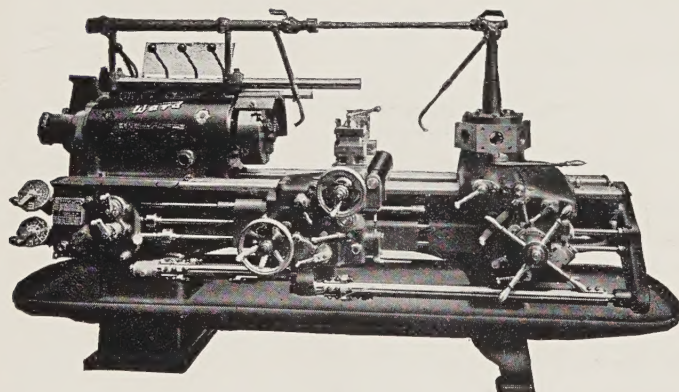


Illustration shows a No. 7 Combination Turret Lathe with Patent Covered Bed, Ball and Roller Bearing Headstock, Ground Gears, Automatic Lubrication etc.

Height of centre $8\frac{3}{4}$ "
Swing over Bed Covers 16"
Diameter of hole through spindle $2\frac{5}{8}$ "
Range of spindle speeds 26-1000 R.P.M.

CATALOGUES ON REQUEST

H. W. WARD & Co., Ltd DALE ROAD
SELLY OAK BIRMINGHAM

STILL IN USE ON SILVER JUBILEE ENGINES

SYNTHOLUX

SYNTHETIC PAINT

WITHSTANDS THE
SEVERITY OF
CONDITIONS ON



THE FASTEST REGULAR RUN IN ENGLAND

SYNTHOLUX IS QUICK DRYING AND ENABLES PAINTING OPERATIONS TO BE CARRIED THROUGH SPEEDILY. IT GIVES A HARD, EASILY CLEANED SURFACE WHICH IS ELASTIC AND DURABLE.

DURABLE UNDER ALL CONDITIONS

DOCKER BROTHERS, LADYWOOD, BIRMINGHAM 16.

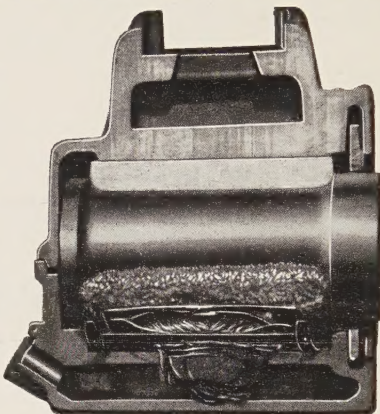
Telegraphic Address : OILER, YORK

Code used : ABC 5th Edition Telephone : 2946

THE ARMSTRONG OILER C^o, L^{td}. YORK

Patentees and manufacturers of The « **ARMSTRONG** » Oiler
Silver Jubilee fitted throughout

For lubricating
All Types of Railway
and Tramway Journals
Efficient and Perfect
in Every Detail



WATER PROOF
OIL PROOF
DUST PROOF
FOOL PROOF

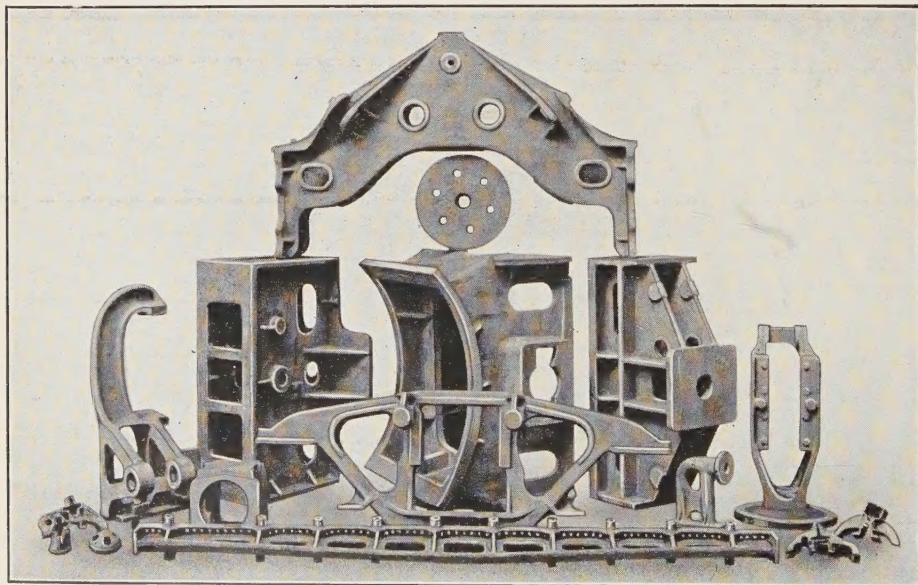
" **ARMSTRONG OILER** " fitted with Oil Seal for tip Wagon Axle Boxes
SAMPLE SETS FOR TRIAL SUPPLIED FREE OF CHARGE

COLTNESS IRON CO. LTD.

NEWMAINS, LANARKSHIRE,
SCOTLAND.

WE SPECIALIZE IN LOCOMOTIVE STEEL CASTINGS

Wheel Centres, Domes, Piston Heads, Horn Blocks, Axle Boxes, etc., of which we are the largest Makers in Great Britain
Steel Castings up to 10 tons - Iron Castings up to 50 tons



WORKS
NEWMAINS

Telephones
212 - 213
214 - 215
WISHAW

Telegraphic
Address
"COLTNESS"
NEWMAINS

HEAD
OFFICE

36, Robertson St.
Glasgow, c. 2.

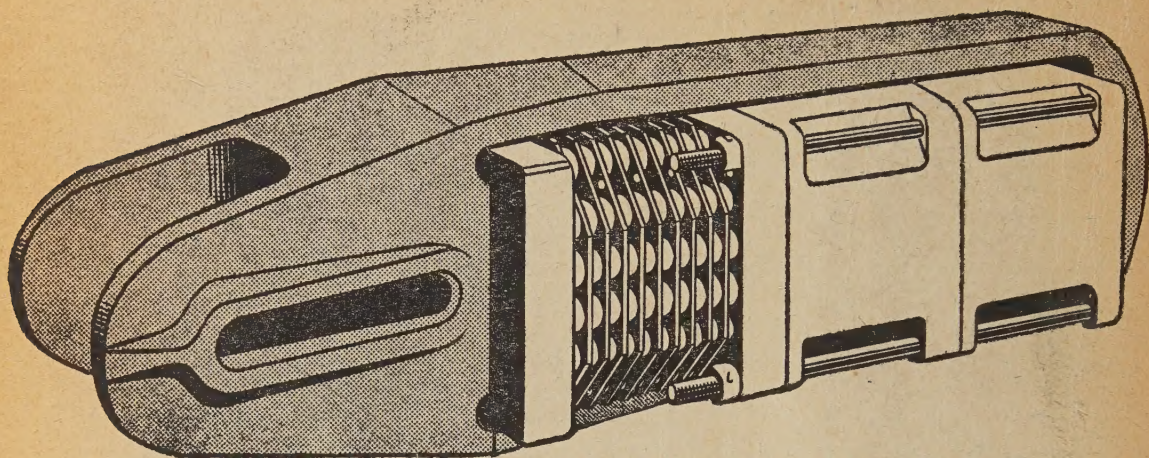
Telephone
Central
9584

Telegraphic
Address
"COLTNESS"
GLASGOW

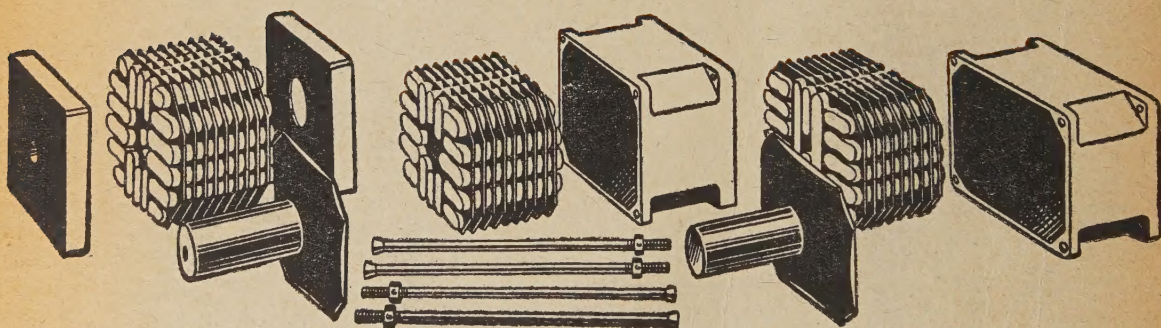
LONDON OFFICE : 10, IDDESLEIGH HOUSE, WESTMINSTER S. W. 1

SPENCER-MOULTON

PATENT DRAFT GEAR



AS USED IN YOKES ON SOUTH AFRICAN RAILWAY WAGONS



RUBBER SPRINGS WITH STEEL PARTS BEFORE ASSEMBLY

GEORGE SPENCER MOULTON & CO., LTD.,
2, Central Buildings, Westminster, London, S. W. 1

SOCIÉTÉ FRANÇAISE DES CAOUTCHOUCS SPENCER MOULTON
11, rue du Gazomètre, Rueil (S. & O.)

Argentina : Percy Grant & Co. Ltd., Edificio Britanico, Calle Reconquista 314, Buenos Aires(1)
Belgium : J. Galler, 7, rue de la Science, Brussels
Brazil : M. Almeida & Co., rua Boa Vista, 10, Sao Paulo
Denmark : A/S Frichs, Post Box No. 115, Aarhus
Holland : Koopman & Co., Gebouw « Atlanta », Stadhouderskade, 6, Amsterdam W.
India : George Spencer Moulton & Co (India) Ltd., 8, Esplanade East, Calcutta
Sweden : Svenska Ackumulator Aktiebolaget Jungner, Riddargatan 17, Stockholm 7
Switzerland : O. L. Borner, Limmatquai, 3, Haus Bellevue, Zurich 1.

M. WEISSENBRUCH
S. A. -- BRUXELLES